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Turbogenerators and Condensers for Modern Power Plants

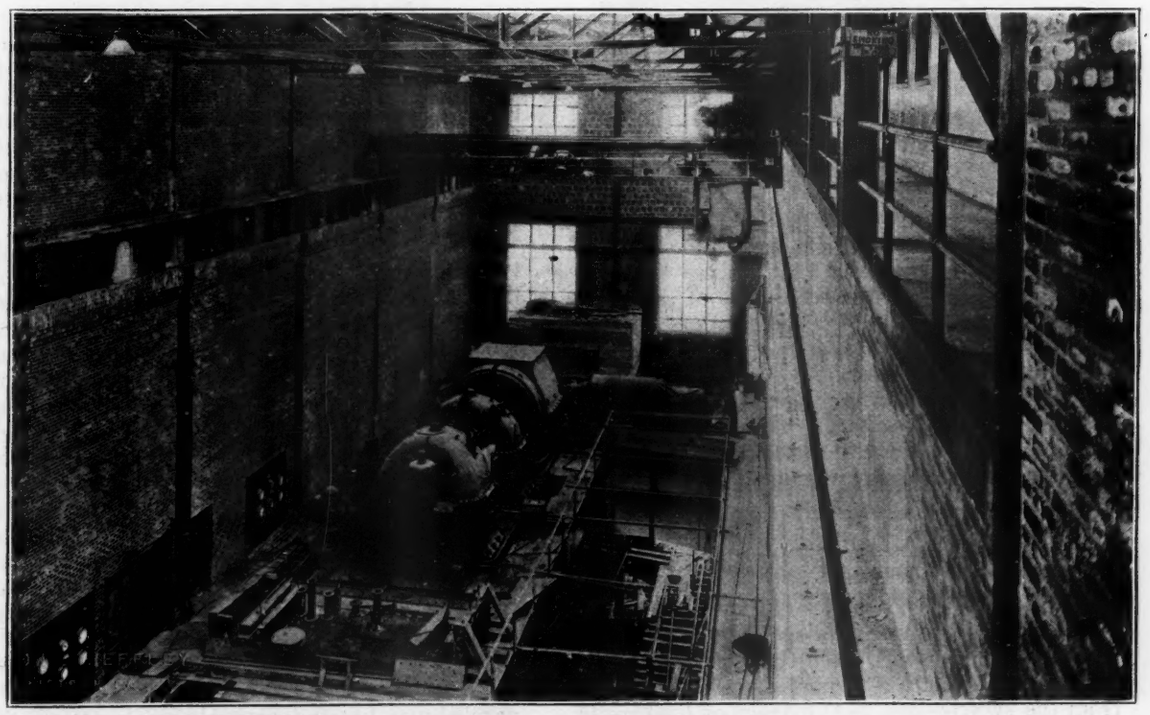
Capacity of Station at Mine Mouth Limited by Available Supply of Condenser Water—Quality of Water Determines Type of Condensers Employed—Turbine Nozzles Selected After Full Analysis

By A. H. GANSHIRD and R. E. CAROTHERS

Power Sales Department, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Within the last 2 or 3 yrs. there have been completed several super-power stations at the coal mines, which will probably become most important factors in future power development of this country. In the study of the super-power situation, however, it has been learned that the future super-power zone will not be supplied by three or four mammoth power stations at the mouth of the coal mines. There are several difficulties which are encountered when planning such a power zone, the greatest of which is the question of obtaining enough condensing water at the coal mines. This means that instead of stations of the size of 300,000 kw., the size of the stations at the coal mines will be from 50,000 to 100,000 kw.

One of the most interesting examples of a station of this character is the Seward plant of the Penn Public Service Co. of Johnstown, Pa. The first unit, a 20,000-kw. Westinghouse turbogenerator, was turned over several weeks ago, and a similar unit will be installed in a short time. The ultimate capacity of this station will be about 100,000 kw. This ultimate capacity was determined greatly upon the amount of condensing water available. The plant is on the Conemaugh river at Seward, and from records of this river covering a period of years the conclusion was reached that Seward was the best location. The low-water flow of the Conemaugh river at this point is regulated by several large dams located at the headwaters, so that condensing water will



View of Main Turbine Room of Seward Plant of Penn Public Service Co., Showing First 20,000-Kw. Turbogenerator in Place.

be available for an ultimate capacity of 100,000 kw.

Within 600 ft. of the station the mine owned by the Miller Coal Co. is developed to a capacity at this time of 500 tons per day. The mine equipment is capable of producing a maximum output of 1000 tons per day. This coal company owns 1700 acres of "B" vein coal, one of the best steam coals in the Western Pennsylvania fields. There is an ample reserve for supplying this station for a period of over 50 yrs.

The generating equipment in this new plant consists of two 20,000-kw., 3-phase, 60-cycle, 11,000-volt Westinghouse turbine generating units, with direct-connected exciters, served with a Westinghouse Le Blanc jet condenser. These turbines are of the double-flow type with the cylinder parts that receive high pressure steam made of cast steel, and the low pressure or exhaust ends are made of cast iron. The turbines are designed to operate on 275 lbs. steam pressure with 180 deg. F. superheat and a 29-in. vacuum.

View Showing Installation of Twin Jet Condensers, Air Ejectors and Water Suction Lines.

After a careful study had been made of the load-factor of the station the turbines were nozzled with their most efficient point at 16,000 kw. on the primary valve and 20,000 kw. on primary and secondary valves. To take care of emergencies and improved power-factor conditions on the transmission system the steam ends of these turbine generating units are arranged by means of a supplementary valve to carry a load of 25,000 kw., with 100% power-factor at the generator.

Provision Made for Regulation of Speed by Switchboard Operator.

The turbines operate at a speed of 1800 r.p.m. and are equipped with speed-changer motors and a governor so that the turbines may be paralleled from the switchboard and division of load made between the units by the switchboard operator. The turbines are equipped with automatic safety devices that will operate in case of overspeed and that can also be manually operated at any time. The generators are direct-connected to the turbine rotor by means of a flexible coupling, the turbine rotor and generator rotor being supported by four bearings. The generator rotors are constructed with ventilating fans on each end of the rotor, which draw air through ducts from the outside of the building and through air washers, forcing it through the generator for cooling purposes. The warm air discharge from the generator is carried in concrete ducts to forced draft fans which deliver air to the stokers under the boilers.

Lubrication for turbine units is supplied by the modern Westinghouse lubricating system which is part of the turbine units, the oil being filtered and cooled on each cycle through the turbine generator bearings. These complete units have been designed and installed to give maximum reliability and continuity of service.

Water available for condensing purposes contains considerable free acid and is of such poor quality that if used with a surface condenser the tubes would corrode very rapidly and replacements would be costly. Jet condensers will effectively withstand the corrosive action of this water. If surface condensers were used the cost of replacing tubes would be high, but the condensed steam could be saved and used for boiler feed water. If jet condensers are used the condenser maintenance would be low, but it would be necessary to provide good boiler feed water from some outside source. In this particular case it was found that it would be more economical to use jet condensers and treat the boiler feed water than to use surface condensers and use the condensate for most of the boiler feed and only treating that needed for makeup due to losses from leaks, etc.

Twin Jet Condensers Give Flexible Capacity and Provide for Easy Repairs.

The initial condenser installation in this plant consists of two twin Westinghouse Le Blanc jet condensers. Each half of each condenser circulates 14,000 g.p.m., or the condenser for each turbine circulates 28,000 g.p.m. The water from each condenser is removed by two centrifugal pumps, each driven by a steam turbine through reduction gears.

A single condenser of the same capacity as the twin condenser could have been furnished, but the twin outfit is more economical to operate under certain conditions of load and gives a more reliable installation. With relatively light loads on the turbine, and with cold circulating water, only one half of the twin condenser need be operated. The one condenser would give a good operative vacuum under such conditions, and quite a large saving in energy would result in shutting down one condenser. The twin outfit is more reliable, since if anything happens to one condenser a reasonable vacuum could be maintained with the other one while making the necessary repairs. The question of reliability and flexibility is the determining factor between a single or twin jet condenser.

In order that two condensers operating in parallel may function properly it is necessary that the steam condensed by the two sections be divided as nearly equal as possible. In order to accom-

plish this it is necessary to provide three connections between the two condensers. There must be a large steam equalizing connection which will allow steam to flow from one condenser to the other, depending on which condenser is doing the least work. It is necessary to equalize the air pressure in the two condensers so that the air pumps will divide the work equally. In order that both condensers will handle the same quantity of water there is a water equalizing connection placed between the two pump bodies. This maintains the same water level on the suction side of the runners for both pumps and they, therefore, will handle approximately equal amounts of water.

Each twin condenser is equipped with seven Westinghouse Le Blanc 2-stage steam-jet air ejectors, any one of which may be operated independently as the load and vacuum conditions demand. Only five of these ejectors will be required to maintain 28.5-in. vacuum with full load on the turbine, so the remaining two ejectors are for spares and can be put into service when it is necessary to repair any of the other ejectors. Ejectors are supplied with steam at normal boiler pressure and discharge into a condensing tank where the steam used is condensed by the water used for cooling the transformers in the station and water used in the oil coolers for the turbines. This air-handling system is thermally very efficient, as all of the heat not used is actually returned to the boiler in the feed water.

These condensers are started by means of forced injection. Spray pipes are installed in the connecting pieces between the turbines and condensers and water is piped to these from the station service piping.

The size of the air ejectors required to remove the air is dependent upon the volume of air to be handled, and in order to keep this to a minimum the air is cooled as much as possible before entering the ejector. This is accomplished by placing an air cooler between the condenser and the ejector inlet, and in passing through this air cooler the air is drawn through a spray of water taken from the main injection water piping and its temperature is therefore reduced to the temperature of the coldest water available. This keeps the proper size of the ejctors down to a minimum. A 36-in. atmospheric relief opening is provided in the equalizer connection between each pair of condensers to properly protect the turbine and condensers should for any reason the condenser pumps stop or the injection water be shut off and the vacuum be lost.

SYNCHRONOUS CONDENSERS OPERATED BY AUTOMATIC CONTROL.

Elimination of Cost of Regular Operators Makes Possible the Advantageous Use of Condensers in Many Places.

By C. M. GILT.

At first thought, wattless current conveys the impression of a circulating current that does not mean energy, and so costs nothing. The efforts that central stations are making to reduce this wattless current to a minimum indicate that there is more to the story. The limitations of capacity of most electrical equipment is determined by current and voltage and not by energy. A freight car of iron ore is loaded to its capacity by the combined iron and impurities and not by the iron alone, even though the impurities have no value. And in a similar manner lagging current not only helps to fill up the current carrying capacity of equipment, but in some cases actually reduces the kv-a. capacity of the equipment. An alternator of normal design will deliver less kv-a. at a power-factor of 60% than at 80%, due to field limitations; and a transformer or line has a greater regulation for the same load in kv-a. at a lower power-factor. Thus the cost of electrical equipment is determined by its kv-a. capacity, and its cost per kv-a. may actually be increased if required to operate at low power-factor.

In general, losses depend upon total current and not upon energy current alone. The losses in a generator are increased when operating at low power-factor, due to the extra field current required. The difference in efficiency of a generator when operating at unity power-factor and 80% power-factor may be as high as 2 or 3%. It is apparent that wattless current costs money, and purchasers of electric power must pay for it whether the charge is distributed over all by a higher rate or whether an additional charge for wattless current is made to purchasers whose power-factor is below some established minimum. The amount of wattless current drawn from the line may be reduced to a minimum by keeping transformer and induction motor capacity at the smallest value compatible with the load conditions. When reduced to a minimum by this means there remains a considerable amount of wattless current that must be furnished over the lines by generators or by some form of condenser.

STATIC CONDENSERS USEFUL FOR CERTAIN PURPOSES.

Static condensers are available at prices such that in the smaller sizes they may be installed with lower combined fixed charges and operating costs than synchronous condensers. They require no regular attendants and may be designed to be connected and disconnected from the line by a time switch if load demand or conditions warrant. For large installations, or where voltage control by condenser capacity is important, the synchronous machine offers more advantages than the static. In the larger capacities the initial cost of a synchronous condenser is appreciably less than that of the static condenser, so that even though its losses are somewhat higher the annual charges against it are less. As an additional advantage its output can readily be varied to hold constant voltage or power-factor or to meet other conditions.

AUTOMATIC CONTROL OF SYNCHRONOUS CONDENSERS AMPLY DEMONSTRATED.

Until comparatively recently operating companies have felt that it was necessary to maintain attendants with rotating machinery, and frequently the savings effected by a synchronous condenser would not pay its own charges plus the attendant's wages. The experience of the past few years has amply demonstrated the reliability of equipment manufactured to automatically control even 60-cycle high-voltage syn-

chronous converters. A synchronous condenser, with no commutator except that on the little exciter, is much more trustworthy and less sensitive than a converter, and so lends itself more readily to automatic control. The unqualified success of one 3000-kv-a. condenser demonstrates the fact that automatic synchronous condensers are beyond the experimental stage.

The fact that condensers can be suitably controlled so as to make regular attendants unnecessary makes possible the reduction in operating costs of many units now installed. It also makes economic the installation of new apparatus in places that would not justify the maintenance of operators.

It is relatively rare, except on fairly long transmission lines, that large condensers are at all applicable. Loads are scattered and, excepting the larger industrial customers, are so small that synchronous condensers cannot well be installed directly at the loads. At junction points of feeders or distributing switching stations the load transmitted may be large enough to warrant the installation of a condenser operated automatically.

Distributing substations may very easily be made automatic with feeder circuit-breakers that will reclose once or twice if tripped out by an overload and give better service than is commonly provided by operators. In these substations automatic condensers may be installed to correct the power-factor and reduce the losses in the transformers and high-tension lines as well as relieve generating capacity. If the reactance of the transmission line is great enough the condenser may be designed to hold constant voltage on the low-tension bus by power-factor control. If the substations are small enough and sufficiently scattered the low-tension feeders may be made short enough so that feeder regulators may be eliminated if the bus voltage is regulated by a condenser. Automatic distributing substations with condensers by eliminating operators' wages make possible the installation of a greater number of smaller substations, with a reduction in secondary copper and losses, than can economically be provided by the old scheme.

Power-Factor Clauses in Contracts Make Use of Condensers Profitable.

There are many industrial plants that require so much power that they have a fairly large substation and usually purchase high-tension power. Power-factor clauses in power contracts serve as a stimulus toward improving power-factor of such loads. A condenser installed on the low-tension bus would not only give them the benefit of better rates, but would reduce the transformer losses and materially improve the regulation. While the speed of induction motors is fairly independent of voltage variation the point of break-down torque and the heating are seriously affected by voltage changes. The speed of wound-rotor induction motors operating at reduced speeds by means of resistance inserted in the secondary circuit is materially changed by voltage variations. Artificial illumination plays such a large part in the product of the industrial plants that good voltage regulation is in reality more essential than plant managers sometimes realize.

Regular attendants at the distributing bus are by no means always necessary, and a synchronous condenser may be added to operate automatically without adding the cost of regular operators. The expense of improving the power-factor and thereby gaining better power rates, reducing transformer losses and improving the output of the plant as a result of better voltage regulation is the fixed charge on the condenser and its control, the small losses of the condenser, and a very minor charge for inspection, tests and maintenance.

In general, it may be stated that synchronous condensers are of great advantage in reducing losses and investment charges in a-c. systems. In order to provide the maximum advantage they should be located near the loads requiring magnetizing current. The automatic control of condensers by eliminating the expense of operators makes it possible to scatter the condensers in the most advantageous capacities throughout the system so as to place them at or near loads that require lagging current. The automatic control makes possible the operating of condensers where the biggest return can be obtained from the investment made.

THE AVAILABLE WATER POWER IN CANADA.

The following new compilation by the Dominion Water Power Branch of the Department of Interior shows the available and developed water power in Canada:

AVAILABLE 24-HR. POWER AT 80% EFFICIENCY.

Province.	Available 24-hr. power at 80% efficiency. At ordinary min. flow, hp.	At est. flow for max. dev. (Dependable for 6 mos.), hp.	Turbine installation hp.
1	2	3	4
British Columbia	1,931,142	5,103,460	304,535
Alberta	475,281	1,137,505	32,492
Saskatchewan	513,481	1,087,756	.....
Manitoba	3,270,491	5,769,444	33,447
Ontario	4,950,300	6,808,190	1,052,048
Quebec	6,915,244	11,640,052	925,972
New Brunswick	50,406	120,807	21,180
Nova Scotia	20,751	128,264	35,774
Prince Edward Island..	3,000	5,270	1,933
Yukon and Northwest Territories	125,220	275,250	13,199
	18,255,316	32,075,989	2,470,580

The figures listed in Columns 2 and 3 in the above table represent 24-hr. power and are based upon rapids, falls and power sites of which the actual existent drop, or the head possible of concentration, is definitely known or at least well established. Innumerable rapids and falls of greater or lesser power capacity are scattered on rivers and streams from coast to coast which are not as yet recorded, and which will only become available for tabulation as more detailed survey work is undertaken and completed. This is particularly true in the more unexplored northern districts. Nor is any consideration given to the power concentrations which are feasible on rivers and streams of gradual gradient, where economic heads may be created by the construction of power dams, excepting only at such points as definite studies have been carried out and the results made matters of record.

The figures in Column 4 represent the actual water wheels installed throughout the Dominion. These figures should not be placed in direct comparison with the available power figures.

Superheated Steam a Factor in Power Plant Economy

Capacity and Efficiency of Equipment Increased at Moderate Cost by Installation of Superheaters—Savings in Connection With All Types of Prime Movers — Advanced Practice at Hell Gate

By R. A. HOLME
The Superheater Co., New York City.

Outside of the steam railroad field public utility engineers have made greater strides in the application of superheated steam than those connected with any other single branch of steam engineering. Because of the enormous power developed by public utilities and because of the necessity of still greater expansion of utilities, superheated steam is a paramount necessity for economy. Public utility power plants, as nearly as can be estimated, produce 13,000,000 hp. (steam), or about 30% of the total power produced in the country by steam exclusive of steam locomotive power. Reduced to electrical units this represents a total load of about 9,000,000 kw. At an average consumption of 3 lbs. of fuel per kw-hr., and assuming a 40% load-factor for 365 days, the fuel consumption would amount to nearly 48,000,000 tons. With fuel costing $3.50 a ton, nearly $170,000,000 a year is paid for fuel by public utility operators. A very small saving in fuel consumption per kw-hr. would reflect a stupendous saving in a year's operating cost, a 10% conservation in fuel representing a saving of about $17,000,000. Because such a saving is possible public utility companies owe it to themselves, to their consumers, and to the nation's resources to take steps to stop avoidable fuel waste.

There are, in general, two courses open to utility corporation engineers to effect higher economies. The first of these represents past practice and involves the scrapping of power equipment considered either uneconomical or inadequate and replacing such power equipment with the most modern and the most highly economical equipment. While this practice has, up to within a few years, been not only possible and practical but justifiable, the situation faced today involves obstacles which in most cases will preclude solving the problem in such a manner. High increases in material and labor costs and high money rates make it financially impractical to tear out equipment that can be modernized.

We must view the situation with a knowledge of the facts. Past practice and past developments were justifiable, but viewed in the light of the situation now existing and likely to exist for many years to come a second course seems advisable—the course of making the most effective use of present equipment. By modernizing the smaller plants they may be converted to operate at nearly as high an efficiency as the more modern and larger plants. Because such results can be obtained at a small outlay of capital—an outlay which is but a fraction of the cost of scrapping old equipment and installing new—an extensive program of modernization of these plants, through the many methods of conversion possible, should be carried out.

Engine Efficiency a Function of Utilized Temperature Range.

That superheating is a logical step toward economy may be readily appreciated when we analyze its effect on the fundamental formula for efficiency of a heat engine. Take the formula, $Efficiency = \frac{T_1 - T_2}{T_1}$, in which T_1 is the absolute temperature of the steam entering the prime mover, and T_2 the absolute temperature of the heat rejected. By compounding the value of T_2 is decreased and the efficiency, T_1 remaining constant, will be increased. Compounding has served this purpose, but it has taken a better form in the case of condensing engines, by means of which T_2 can be reduced considerably. The other tendency toward greater economy has been in raising boiler pressures or, in effect, the increase of T_1. It will be appreciated, however, that as the pressures for the relatively slow gain in T_1 are increased practical difficulties in plant maintenance are introduced, due to the increase in pressure.

The third and at the present time the most logical step for increasing the efficiency of an engine, and a means also whereby practically all parts of a power plant are improved and made more effective in operation, is the use of superheated steam. The properties of superheated steam which make its use economical in power plants are: (1) It has a much lower thermal conductivity than saturated steam and hence gives up its heat less readily than does saturated steam. With superheated steam, therefore, less heat will be absorbed per unit of time by the engine cylinder or turbine wall and pipe wall. (2) Superheated steam has a larger volume per unit of weight than saturated steam of the same pressure. In a reciprocating engine the weight of steam per stroke for the same cutoff is reduced as the superheat temperature is increased; in a turbine the decreased density of superheated steam offers less frictional resistance to the buckets, thereby increasing the mechanical efficiency of the machine. (3) Superheated steam behaves like a perfect gas and does not begin to liquify until its temperature falls to that of saturated steam at the same pressure.

This property of superheated steam delays the greatest thermodynamic loss, outside of the heat carried away in the exhaust, in any prime mover. These characteristics of superheated steam result in economies which are effected, in general, by increasing boiler efficiency, by reducing condensation losses in steam lines, by reducing steam consumption of the prime mover, and by increasing the capacity of the plant.

Superheating Increases Efficiency of Steaming Equipment.

A definite amount of heat is required to superheat steam to a certain temperature, and this heat is furnished by the fuel. When a definite weight of steam is generated additional fuel will be consumed to superheat this steam. Let us assume a boiler designed without a superheater to give the highest practical thermal efficiency. Suppose we install a properly designed superheater in this boiler. It will be found that the overall thermal efficiency of the combined boiler and superheater will be greater than the boiler without the superheater when evaporating the same amount of water, because by the addition of the superheating surface more heat is absorbed and the final uptake-gas temperature is lowered. A properly designed superheater will not alter furnace conditions in any way, nor will it obstruct unduly the flow of gases through the boiler. Considering a given furnace condition and a given rate of firing these facts are indications of added efficiency.

Many power plant installations are forced by local conditions to operate their prime movers at long distances from the boilers supplying the steam. The long pipe lines carrying the steam may be run out of doors where they are exposed to all kinds of weather. These conditions naturally have a marked effect on the quality of steam when it reaches the point where it is to be used. Superheating prevents condensation in steam lines and results in the delivery of dry or superheated steam within practical limits to the steam user. This advantage is due to the fact that no moisture or water is carried over from the superheater, and also because the low thermal conductivity of the superheated steam prevents condensation. Superheating is advantageous not only from an economical standpoint, but also because it eliminates water hammer and its attendant engine and pipe troubles.

Long pipe lines now carrying saturated steam can be used for moderately superheated steam without any change, resulting in a great saving in the available heat and quantity of steam delivered for power purposes. This fact alone should make the use of superheated steam on long pipe lines a universal practice. When condensation in steam lines is reduced both steam and coal are saved, because in the generation of steam about 90% of the heat absorbed by the water in evaporating it and raising the steam pressure is latent heat. When steam is condensed latent heat is liberated, and unless it performs useful work it is wasted. Condensation, therefore, occurring in pipe lines, represents an absolute waste of 90% of the heat, and if the condensate is not returned to the boiler all of the heat is wasted. A superheater is absolutely essential to raise the temperature of the steam to such a point that all of it may be transmitted to its destination and used without condensation losses.

Importance of Superheat in Steam Turbine Operating Practice.

High-degree superheat is of vital importance

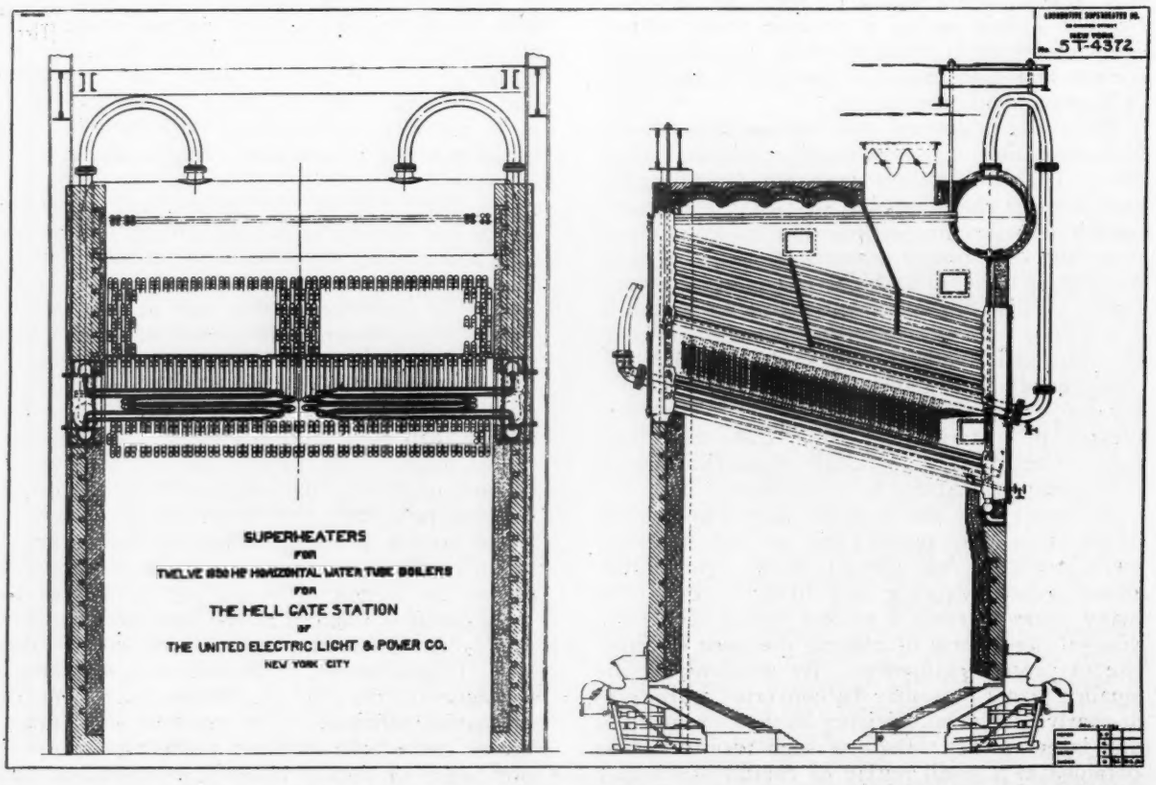


Diagram Showing Method of Installation and Location of Superheaters Provided for 1890-Hp. Springfield Boilers in Hell Gate Station.

in steam turbines, and the steam turbine is particularly adapted to its use. All turbine plants of any size are now using superheat, several modern plants operating at superheat temperature up to 250 deg. F. Turbine manufacturers have made a strong claim in favor of turbines in that a high degree of superheat can be used. The most economical steam prime movers utilize steam with as high as 300 deg. F. superheat. These turbines produce a kilowatt-hour with 11.5 lbs. of steam, or a brake horsepower hour with 8 lbs. of steam. The water rate of an economical steam turbine will be reduced 1% for every 12 deg. F. of superheat up to 200 deg. F. This figure is based on large and economical turbines. Small turbines, inherently less economical, show a greater proportionate saving with superheated steam.

Moisture is particularly detrimental to steam turbines. It reduces the efficiency by the excessive friction between the water and turbine parts. One authority points out that a turbine without superheat is merely a form of "water brake," for every ounce of water passing through, no matter how finely divided, is inert material and serves only to check the running of the machine. The internal surfaces of the turbines are greatly increased beyond those in reciprocating engines, and the effect of temperature range in augmenting condensation is great, even though the temperature in the turbine does not change so widely. The effect of water and moisture on the turbine blading is too well known to be more than mentioned. The erosion of turbine blades due to water is very rapid, and the effect of this erosion is immediately felt in increased steam consumption. When highly superheated steam is used, however, water is not present to cause this erosion. Blade wear is greatly reduced through superheating, and reblading is necessary only after much longer periods of operation than when saturated steam is used.

Superheating of Steam Increases Efficiency of Reciprocating Engines.

Generally speaking, the reciprocating engine will be benefitted more by superheat than the steam turbine will. The saving to be expected by superheating is dependent on the amount of cylinder condensation that would occur in the same engine if no superheat were used. Evidently, the greater this condensation the larger is the saving possible. When steam is superheated 200 or even 250 deg. F. it can be exposed to the cooling action of the steam chest and cylinder walls without condensation, and has 30 to 40% greater specific volume than saturated steam of the same pressure. For example, 1 lb. of water at 170 lbs. pressure (absolute) produces 2.68 cu. ft. of saturated steam at 368 deg. F. After passing through the superheater and gaining 200 deg. F. superheat the volume will have been increased to 3.54 cu. ft. A part of this increased specific volume is lost before the expansion of the steam in the cylinder takes place on account of the cooling action of the cylinder head, piston and cylinder walls. While the superheat in the steam entering the cylinder may be 200 to 250 deg. F. the superheat of the steam in the cylinder at the moment of cutoff is considerably less. The elimination of all condensation losses together with the increased volume of the steam effects substantial savings in the steam consumption and in the fuel consumption when compared with saturated steam operation under the same conditions. The accompanying table shows clearly what effect superheating has on the relative steam consumption of prime movers.

All the foregoing remarks indicate one exceedingly important point to be considered in the application and use of superheated steam; namely, that the higher the superheat within practical limits the greater the resulting economy. From a commercial standpoint, therefore, the highest superheat will disclose the greatest returns on the investment, and it is to the best interests of public utility operators, and in fact the duty of their engineers, to investigate carefully in order to ascertain just what maximum economy they

RANGES IN STEAM CONSUMPTION BY PRIME MOVERS.

Type engine.	Steam consumption in lbs. per hp. hr. Saturated steam	100 deg. F. superheat	200 deg. F. superheat
Simple noncondensing	29- 45	20- 38	18-35
Simple noncondensing automatic	26- 40	18- 34	16-30
Simple noncondensing Corliss	26- 35	18- 30	.....
Compounding noncondensing	19- 28	15- 25	13-22
Compound condensing	12- 22	10- 20	9-17
Simple duplex steam pumps	120-200	80-160	.....
Turbines, noncondensing (kw-hr.)	28- 60	24- 54	21-48
Turbines, condensing (kw-hr.)	12- 42	10- 38	9-34

can obtain in their plants through the use of high-degree superheat. In making such an investigation it is impossible to be guided entirely by precedent as no two plants present the same conditions, and hence the degree of superheat which may be practically used will vary with the conditions existing in each plant. Every factor in plant operation should be exhaustively studied before a conclusion is reached. A recent development in the application of superheated steam discloses the result of the most earnest study given to the problem of obtaining the utmost in power plant economy. Because the plant involved is a utility property which represents the last word in central station practice all members of the N. E. L. A. will be particularly interested in a description of the superheater equipment. The plant referred to is the new Hell Gate station of the United Electric Light & Power Co. in New York City.

From the accompanying illustration it will be appreciated that this development is a radical departure from the precedent of any previous designs. The design is the result of close study and co-operation between the plant engineers and the engineers of The Superheater Co. The steam generating equipment involved includes twelve 1890-hp. Springfield cross-drum boilers. Each superheater is designed to deliver 200 deg. F. superheat at 200% rating, and consists of two sets of units and two sets of headers located in the side wall on each side of the boiler. The headers are suspended from the steel work independent of the brick work and are thus free to expand and contract in all directions. All joints are readily accessible from outside the boiler. The outlet of the superheated steam header is located

opposite the inlet end of the saturated steam header, producing a uniform steam flow through the headers and units for all ratings. The superheater units are attached to the headers by the latest design "Elesco Clamp" joint construction. The female half of the metal to metal joint between each unit end and the header is located in the header. It is a ground seat made at an angle of 45 deg. The ball end of the joint is formed integral with the tube by a special process of forging, and is faced and ground. Clamps and nuts maintain the joints between the units and the header. As before noted, these joints are so placed as to be accessible from outside the boiler setting.

From the illustration it will be noted that the superheater heating surface is located in higher gas temperatures than in any previous designs. Such a location was selected in order to obtain a high superheater efficiency at all ratings. The heating surface has been laid out to obtain a uniform distribution of the surface in relation to the gas flow, the superheater units being at right angles to the water tubes and staggered with relation to the gas flow. The return bend used in this design is also worthy of note, because by its application it is possible to distribute the superheater surface in a way which would otherwise be impossible. This return bend is machine forged on the ends of the units from the metal of the pipe itself by a special mechanical forging process. The distribution of metal in the return bends is such that there is an increased metal section in the bend at the point of the shortest radius. A continuous pipe results, the return bend of which is actually stronger than the body of the pipe itself.

Superheated steam is too important a subject to be treated in a general way. There are many phases to its utility, any one of which would be a topic for study. We have, however, endeavored to treat a big subject briefly. There is an opportunity in every plant, regardless of size, for the use of superheated steam. Conservation in fuel is imperative and increased capacity is demanded. Superheated steam, correctly applied, is an investment which accomplishes both these urgent necessities.

LOW-HEAD HYDROELECTRIC PLANT IN STILLWATER VALLEY.

Power Development Made to Serve Small Towns After Site Had Been Used for 100 Yrs. and Abandoned by Grist Mill Operators.

In 1908 West Milton, O., and the nearby villages of Laura, Georgetown and Phillipsburg, besides other rural communities, were clamoring for electricity, but none of these villages were large enough to support a steam power plant individually. Collectively they have a population of about 5000 people within a radius of 9 mi.

Through the village of West Milton runs the Stillwater river, which has a minimum flow of about 2500 cu. ft. per min., this low stage lasting about 30 days usually, but some years the minimum flow is as much as 10,000 cu. ft. per min. Nearby was an old "grist mill" which had been in operation for nearly 100 yrs., but with competition caused by the development of the lands of the West, together with the developments of large water powers in the West, as at Minneapolis, the "grist mill" was not profitable in its operation—not only this particular mill, but all such throughout the entire Middle West—so the "old grist mill" was abandoned. This mill was located in a gorge about 80 ft. below the level on either side of the Stillwater river, and only about 300 ft. wide. The adjacent farm lands were partly fenced with granite boulders which were strewn over the surface probably during the glacial period. The farmers were anxious to dispose of these unsightly boulder fences. L. A. Pearson bought the old mill, built a concrete dam at the site of the old dam, concrete penstocks, retaining walls, bridge across the tail race, etc. The slope of the river at this point is about 5 ft. to the mile, and the dam is about 10.5 ft. high with a tail race of about 600 ft.

There are about 700 customers now receiving service, and the plant has a load of about 250 hp. Mr. Pearson believes that where economic conditions prevail the energy of every river from its summit to the sea should be conserved and synchronized as one plant composed of the various units along the banks.

Hydroelectric Plant at West Milton, O., Built at the Site of an Old Grist Mill Deserted After 100 Yrs. of Service.

Illumination and Fixtures for Department Stores—Part II.*

Character of Goods on Display and Type of Interior Finish Determine Quantity of Light Required—Modern Lamps and Glassware Permit of Results Not Obtainable With Early Equipment

By A. L. POWELL

Lighting Service Department, Edison Lamp Works, Harrison, N. J.

Totally indirect.—There are two main types of totally indirect units: One employs mirrored-glass bowl-shaped reflectors inverted within decorative housings; the other utilizes a shallow porcelain enameled steel reflector in the same manner. The mirrored type is slightly more efficient, while the enameled variety is less expensive. Many styles of housings are available, and these are finished in any tint suited to the particular interior in which they are to be installed. The illumination from the totally indirect system is very well diffused and no light source is visible. These factors cause the store to be most comfortable, and the working conditions are pleasant.

To prevent the opaque fixture appearing as a dark spot against the illuminated ceiling a form of unit known as a luminous-bowl indirect is employed. Mirrored inverted reflectors are used, but a small amount of light is allowed to escape and illuminate the glass bowl which conceals the mechanism.

Attempt has been made below to classify the various types of reflecting devices suitable for use in the store in the order of their effectiveness in certain directions. This summary is based on the average high-grade store finish of pure white and is not absolute; as, for example, some dense opalescent inclosing globes may be less efficient than a semi-indirect unit in a room with a light ceiling. For maximum light on the counters for

*Part 1 of this article appeared on p. 381 of the Sept. 10, 1921, issue of Electrical Review.

Night View in Furniture Section of Progressive Store—Comfortable Lighting Provided by 100-Watt Type C Lamps in Semi-Indirect Fixtures.

a given amount of power the order selected is as follows: Efficient prismatic bowl reflectors, prismatic inclosing units, dense-opal bowl reflectors, medium-density-opal bowl reflectors, light-density-opal bowl reflectors, opalescent inclosing

Semi-Inclosing Units Employed With 200-Watt "Daylight" Lamps in Millinery Department.

globes (quite dependent on the kind of glass used), semi-indirect, and totally indirect. For diffusion and softness of illumination the order selected is as follows: Totally indirect, semi-indirect, opalescent inclosing globes, opalescent bowl reflectors, and prismatic units. For a bright appearing store the order chosen is as follows: Opalescent inclosing globes, semi-indirect, opalescent bowl reflectors, prismatic units, and totally indirect.

The multiple-unit fixture or chandelier for direct lighting is no longer generally used for store lighting. There is no necessity of grouping several lamps to get sufficient light, for such a wide range of sizes is available that a standard lamp giving within a few per cent of the desired output of light can be secured. Except in those parts of the building where decoration is of major importance very simple designs of fixtures serve best.

Spacing of Outlets and Hanging Height Required to Produce Best Results.

In the large store the spacing of outlets is usually governed by the size of bay and the arrangement of outlets adopted. From one to five outlets can be symmetrically arranged in a square bay, and the wide range of sizes of tungsten lamps make them especially adaptable. In the case of a 20 by 20-ft. bay the following combinations might apply: One outlet with one 300-watt type C lamp; two outlets with two 200-watt type C lamps; four outlets with four 100-watt type C lamps, or five outlets with four 75-watt and one 100-watt type C lamps. This assumes that similar reflecting or diffusing equipments are used with each of these combinations.

As a general rule it is never advisable to place lamps further apart than the ceiling height. In many stores the ceiling of the first floor is much higher than those of the upper floors, and while one large unit per bay might be satisfactory on the main floor the others would probably require at least two outlets per bay.

Using a few outlets keeps the cost of wiring at a minimum and permits the economical use of the larger and more efficient lamps. On the other hand, with the smaller lamps the light at any one point is received from a greater number of sources; hence the possibility of shadows is lessened, and the failure of one unit does not put a section in darkness. It is desirable to have an even distribution of light at the counter level in order that there may be no spots of shadow. This condition can be fulfilled by hanging the lamps at suitable heights. In general the following rule applies: It is always desirable to place lamps as high as possible to keep the light sources from the line of vision, but this should not be carried to an extreme so that a distorted appearance results. Knowing the intensity of light in foot-candles desired, the type of unit, color of walls and ceiling, it becomes a relatively simple matter to determine the size of lamp, spacing and hanging height which will produce the necessary illumination.

Present Practice in Store Lighting Determined by Investigation.

In order to obtain data as to present practice in the lighting of large drygoods and department stores inspection was made of practically all the leading stores of this nature throughout the United States.

The following is a brief summary of the results of this investigation: The store is usually divided into bays by supporting columns, and the average dimension of these is 20 by 20 ft. The ceiling height in the majority of cases is such as to permit satisfactory illumination with one outlet per bay on the first floor, while the upper floors are usually provided with 2 or 4 outlets in each section. In the more recent installations the larger number of outlets is applied to all floors. A few examples of the 3- and 5-outlet arrangement were noted.

All of the equipments mentioned under the section on choice of a reflector are employed. Diffusing inclosing globes of various styles with single-stem or chain suspension predominate, patent semi-inclosing units and semi-indirect fixtures of various types coming next in order of importance. Quite a few notable installations of totally indirect lighting were encountered. Opalescent and prismatic deep-bowl reflectors on single-chain or stem fixtures have a wide application where expense must be kept at a minimum. Common sense in the choice of equipment is evidenced by the rapidly decreasing use of multiple-unit fixtures for general lighting.

Occasionally where inclosing globes are used on the main floor opalescent-bowl direct lighting reflectors are used on some of the upper floors. The basement is usually less elaborately lighted; in some cases the fixtures merely consist of the lamp, socket, direct lighting reflector, and a short length of lamp cord. In other cases direct lighting is used with close ceiling-type fixtures.

As will be pointed out later, there are certain parts of the store, such as the restaurant, ladies' waiting room, and jewelry show rooms which demand special illumination, and the most progressive stores light these portions in a distinctive manner.

The advantages of light colored surroundings

are recognized and pure white side walls, columns and ceilings prevail, dark room finishes being indeed rare. Inasmuch as the store is constantly under the surveillance of a rather critical public cleanliness is quite general, and lighting equipment is better maintained in the large store than in almost any other class of service.

Special Lighting Required in Various Locations.

Stairs.—It is necessary that the stairways be particularly well illuminated to eliminate the likelihood of accidents, and proper attention should be paid to the equipment on lamps near the stairway. If a reflector is missing and the bright filament of a bare lamp in the field of view one is likely to be temporarily blinded, stumble and fall. In such an event the management might well be judged guilty of neglect.

The general illumination will in most cases provide sufficient light for the stairways, but if they are located so that they are in partial shadow it is necessary to use wall brackets or ceiling outlets with medium size lamps. These can be equipped with reflectors harmonizing with the unit adopted for general illumination. In the case of inclosed stairways an outlet should be provided at each landing. It is well to have emergency lighting circuits provided for the stairs and main exits.

Elevators.—The elevators should have sufficient light effective on the floor so that passengers can readily see their footing when entering or leaving. Many special devices are available for illuminating the edge of the car. One of these consists of a perforated plate with glass inserts and lamps below the floor shining through this plate. Another scheme is arranged so that when the car is stopped a small lamp inclosed in a reflecting device at the side of the door is turned on, sending a beam of light across the floor. For general illumination of the car itself it is customary to provide a diffusing glass hemisphere at the center of the roof, equipped with two small lamps. In case one lamp should fail the other will still be in service. The space around the entrance to the elevator should be especially well lighted on account of the confusion resulting from crowding. As mentioned above, unshielded light sources near the elevator entrance constitute a serious accident hazzard.

Cashier's department and offices.—Money drawers and tables in the cashier's department must be illuminated to a high intensity to insure speed and accuracy in handling money with a minimum amount of eye fatigue. The lighting of the offices should receive careful attention, for it is most important to protect the eyesight of those devoting their time to clerical work and accounting.

Shipping and service rooms.—In most instances but little attention is paid to the shipping and service sections of the building, and drop lights with inefficient lamps and poor reflectors are scattered haphazardly about. It is real economy to install a modern system of general illumination, employing efficient R.L.M. standard dome reflectors and bowl-enameled type C lamps, in such locations as the shipping room.

Ladies' waiting room.—A low intensity of soft or well-diffused illumination is desirable in the waiting room so that the fatigued shopper can rest in comfort. Artistic features predominate in the choice of lighting equipment, and methods which are used in the home are applicable. A free use of portable or floor lamps with silk and

Wholesale Ribbon Show Room Illuminated by 150-Watt Type C Lamps in Prismatic Inclosing Units.

other decorative shades adds to the coziness of the atmosphere.

Cut-glass and jewelry departments.—If the light is too diffused where glassware or jewelry is being displayed much of the desirable sparkle and life of the merchandise is lost. Direct lighting with clear lamps produces the best effects, and crystal chandeliers are often in good harmony. The quality of light produced by the "Daylight" lamp is pronounced by experts as advantageous in examining and displaying precious stones.

Art department.—Special lighting arrangements are quite essential to provide even illumination over the entire wall surface in the art sections. Properly designed mirrored reflectors have proven most satisfactory for this purpose. The fixtures should be neat and finished to match the general decoration of the room, and the lamps should be entirely concealed from view in order that the pictures may be viewed and examined to the best advantage. The general lighting should be of a low intensity and so placed as to have no distracting influence.

Specialty shops.—In many stores spaces are set aside in imitation of the small shops found along the boulevards, and these offer opportunities for distinctive lighting with a wide variety of ornamental fixtures to choose from. The question of efficiency does not enter when considering the lighting of these rooms, but some system of decorative value should be chosen.

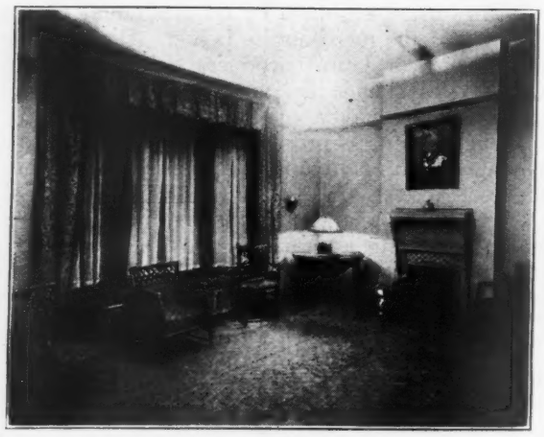
Furniture department.—As already mentioned only a moderate intensity of illumination is required in the furniture department. It is desirable to purchase articles of furniture under conditions similar to those which exist in the home where it will be used. Modified light of a reddish yellow tone is often a desirable feature here, giving the impression of warmth. Decorative types of general lighting fixtures are of service, and silk-shaded portable table or floor lamps served from convenience outlets add to the homelike appearance.

The recently introduced practice of fitting up

small specimen rooms with the furniture on display has much to commend it from a merchandising standpoint. Frequently, however, no thought is given to the illumination of these sections, and standard commercial or store lighting units are applied. In the home an endeavor is made to have the lighting fixtures harmonize with the period of the room decoration, and it should be good policy for the large store to have available sets of pleasing and appropriate fixtures so that suitable lighting for the dining room, bed room or living room is also provided with each change of the furniture. The newly developed interchangeable fixture connection with which you "hang a fixture light a picture" to the ceiling or side wall will be a decided asset here.

Building exterior and entrance.—One's first impressions are always very strong, and if the entrance and exterior of the building have a drawing power a decided psychological advantage is obtained. The main entrance or lobby is often elaborately decorated, and its lighting should be designed so that the architectural beauty is supplemented. An ornate and novel design of fixtures and glassware is often quite important.

Floodlighting the exterior of buildings has become quite prevalent, and many well-known stores have properly designed floodlighting which



Comfortable and Appropriate Illumination in Store Waiting Room.

illuminates the entire exterior of the building to the proper intensity, causing it to stand out against the dark background formed by the sky. Floodlighting with incandescent lamps is very practical and is now almost the universal method.

In conclusion it may be well to sum up a few of the points which must be borne in mind in lighting the department store. One type of unit should be used for an entire floor, except where there are departments which require special lighting, such as for the rug rack, cut glass, art display, and the like. It is not well to have a mixture of all sorts of fixtures in one open space. It is desirable to space outlets symmetrically with the bays and columns. Many stores which are otherwise pleasingly arranged have lamps spaced without any regard for uniformity. All lamps on a floor should be hung at the same height. If this rule is not obeyed the store has the appearance of distorted perspective. In general, the first floor requires a higher intensity than the other floors, not only for the advertising value, but also due to the fact that a person enters here from the daylight and the direct comparison makes the store appear dull if not well lighted. Lamps, reflectors and other accessories should be carefully cleaned at regular intervals. Such service improves the appearance of the installation and keeps the illuminating efficiency at its maximum value. The cost of cleaning is a small item in the operating cost. The periods between cleanings will vary, depending on the atmospheric conditions of the city in which the store is located.

ENERGY LOSSES IN TRANSMISSION AND DISTRIBUTION.

Only About 66% of Total Energy Generated Is Registered by Customers' Meters—Small Amount Used to Operate Business.

An interesting table published in a recent *Bulletin* of the Pacific Power & Light Co. shows what becomes of the power purchased and generated by the company. The Pacific Power &

TABLE SHOWING ENERGY PRODUCED, SOLD AND LOST IN DISTRIBUTION.

Item.	Energy—Kw-hrs.	%
Customers' meters	54,345,319	66.3
Company uses	1,996,974	2.4
Total sales and use	56,342,293	68.7
Lost in distribution	9,660,112	11.7
Total feeder output	66,002,405	80.4
Transmission and transformation losses	16,129,265	19.6
Output and bought	82,131,670	100.0

Light Co. actually sells to its customers only two-thirds of the energy which it generates and buys. The remainder is either lost in transmission, transformation, or distribution, or is used by the company in its business for the lighting of offices and other property and running its power equipment, etc.

During the year 1920 there was measured through customers' meters 54,345,319 kw-hrs. of energy as compared with 49,462,743 kw-hrs. in 1919. If the company could apply its rates to what it generates its problem would be easy, according to the item in the *Bulletin,* for it will be noted in the year 1920 there was generated more than 82,000,000 kw-hrs., or half again as much as was sold.

WHAT IT COSTS TO GROW.

Every time the United States gains a million in population, the public utilities have to raise through the sale of securities $700,000,000 to be spent in extending plants to serve the additional customers created by that increase in population. Chairman Calder, of the Senate Committee on Reconstruction and Production, made this estimate in a recent publication by the committee. That figure represents $700 for every person added to the population, or $3500 for a family of five. Because the normal development was seriously curtailed by the war, utility companies will have to put $2,000,000,000 instead of $700,000,000 into their business to pay for new construction now required. This vast sum of money can be obtained only through maintenance of adequate rates such as will insure a fair interest return to thrifty investors, otherwise their money would go to other industry.

Selecting Condensing Equipment for Power Plants

Construction Features and Some Operating Characteristics That Distinguish Different Types of Condensers — Methods of Supplying Cooling Water, Removing and Separating Air and Condensate

By ROBERT JUNE

The primary reason for the installation of condensers in power plants is the reduction of back pressure on the prime mover. If saturated steam is confined in a closed vessel and cooled condensation of the vapor, with a drop in temperature, will result. The greater the drop in temperature the greater will be the amount of steam condensed and the greater the decrease in pressure. In actual practice all of the steam can never be condensed, since this would call for a temperature of absolute zero—492 deg. F. below the freezing point; hence, the pressure can never be reduced to zero. When water is used for cooling the minimum temperature which can be secured is 32 deg. F., which corresponds to a pressure of 0.0886 lbs. per sq. in., or 0.1804 ins. of mercury. This, then, is the lowest condenser pressure which can be obtained.

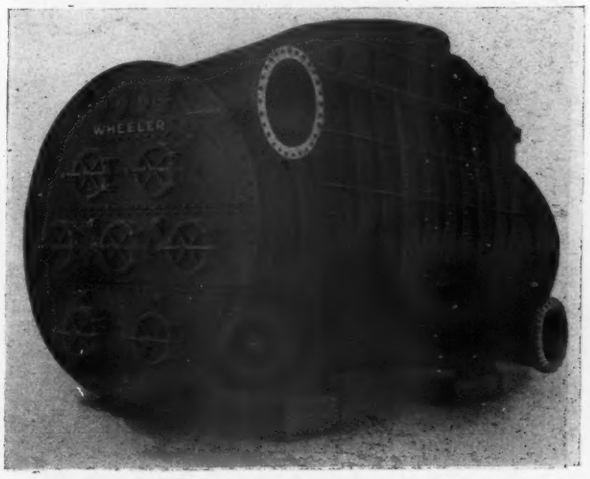
In a condenser the processes of condensation and removal of the air and condensed steam are continuous. The tightness of valves and joints, the amount of entrained air and the temperature to which the condensed steam is reduced are the factors which determine the degree of vacuum obtained. There are a number of ways in common use of expressing the degree of vacuum. Thus, to refer to a 28-in. vacuum is to indicate that the pressure of the atmosphere is 28 ins. of mercury higher than the pressure in the condenser. Vacuum may be expressed by percentage; thus, to refer to a 90% vacuum would indicate that with the barometer standing at 30 ins. a vacuum of 27 ins. had been secured. With a lower barometer, say 28 ins., it would indicate a vacuum of 25.2 ins. It will thus be seen that expressing vacuum in percentage gives an idea of the efficiency of the condensation. In indicating vacuum the point of measurement should always be stated, since the greatest vacuum will be found at the air pump intake, the next highest in the body of the condenser, and the lowest at the steam inlet.

Gain in Power Resulting From Use of Condensing Equipment.

As a general proposition, an engine running condensing will require from 20 to 30% less steam for a given amount of work than will the same engine running noncondensing. Unfortunately, this decrease in steam consumption is not all pure gain. Steam may be used in creating the vacuum or power necessary to operate the condenser auxilliaries, varying from 1 to 6% of the main engine power and depending upon the equipment and conditions of operation. The cost of installation and of the maintenance of the condenser must also be charged up against the saving effected. Even if these deductions are made condensing is found to be, a very profitable operation in power plants where the exhaust steam is not used for heating or manufacturing purposes.

There are many types of condensers in use, but, in general, condensing machinery can be divided into two main groups—surface condensers, where the steam or vapor to be condensed is separated from the condensing water by metal tubes or diaphragms, and jet condensers, where the steam or vapor and the condensing water are brought in actual contact with one another. The jet condenser can further be divided into the regular low-jet type situated generally below the source of exhaust steam or vapor, in which type both the condensed steam and condensing water are discharged to the atmosphere by means of a pump working against a head corresponding to the vacuum in the condensing chamber, and the barometric jet condenser in which the condensing chamber is placed high enough above the hot well to discharge the condensate and condensing water by overbalancing a barometric column.

A vacuum which will raise mercury against the action of gravity 1 in. will raise a column of water 1.132 ft. Therefore, if there were a perfect vacuum in the chamber of the condenser it would raise a column of mercury 30 ins., and a column of water 34 ft., at sea level, against the action of gravity. A vacuum of 28 ins. in the chamber would, therefore, support a column of water in the tail pipe 31.6 ft. high. If the condensing chamber be placed slightly higher than this from the level of the water in the hot well



View of Wheeler Surface Condenser, Showing Manhole Openings in End Plate.

any amount of water added to the top of the column will discharge a corresponding amount into the hot well from the bottom of the tail pipe. By this well-known principle of the barometric column the injection water is discharged from the system in a barometric condenser without the use of a pump. The engine or turbine is protected from water being discharged into the exhaust pipe by placing the upper flange of the condenser higher than 34 ft. above the level of the water in the hot well. It, therefore, is unnecessary to rely on any vacuum breakers or check valves to protect the units from damage from this source.

Influence of Air in Steam on Operation of Condensing Equipment.

If pure water vapor were delivered to the condenser it would be a simple matter to create and maintain a perfect vacuum in the condensing chamber, but, unfortunately, steam always carries with it air and other noncondensible vapors which expand in the condensing chamber after the steam has been condensed, and which would eventually destroy the vacuum if not removed. The amount of air in a condensing system varies greatly, but, roughly, the amount of air measured at atmospheric pressure present in condensing systems on turbines ranging from 500 kw. to 200 kw. may vary from 1 to 15 cu. ft. per min., depending on the conditions of the unit.

Air enters a condensing system through three sources: About 4% of the total amount of air enters through the feed water to the boilers; about 47% leaks through stuffing boxes, joints and porous spots in castings (this amount can be greatly reduced by a little care), and about 49% of the total amount enters with the condensing water (this figure also can be reduced by having a tight suction line or by other means described later). If proper care be displayed in the design, construction, erection and maintenance of the condenser and piping the air leakage can be greatly reduced, and labor so expended more than pays for itself later. A slight leak in a vacuum or stuffing box will cause much more waste of coal than a considerable leak in a steam line. Nobody would think of installing an extra boiler to take care of these leaks in the latter case mentioned, although many dry vacuum pumps have been installed to remove air in the former case. The prevention of practically all leaks in exhaust lines is simply a case of proper design, erection and materials. To eliminate this air, which is present more or less in all condensing systems, is by far the most difficult problem connected with condenser design, and all jet condensers differ from one another only in the means they employ to accomplish this result.

View of a Roturbo Rotary Jet Condenser—A Type Having Distinctive Features.

Reference has been made to air elimination as the most difficult problem in condenser design. Let us see how it is met in a few standard makes of condensers. The Bulkley injector condenser, as the name indicates, removes the noncondensible vapors by the injector action of the condensing water flowing through a contracted throat of special dimensions and designs. The condenser consists of an iron casting machined to the required dimensions and fitted with a heavy brass cone, as shown in the accompanying illustration. Water enters the system at *B* and circulates in the belt about the brass cone *C*, falling through the annular space *G* between the outer circumference of the brass cone *C* and the inner surface of the casting, and forming a moving cone of water *D* with a sharp vortex. Steam enters at *A*, passing through the interior of the cone *C*, and meets the water at *G*, imparting to it what velocity it has on being condensed. This tends to force more water through the annular space. The condensed steam, water and noncondensible vapors are brought down through the hollow cone of falling water *D*, and the noncondensible vapors are discharged through the contracted throat *F*.

The lower portion of the condenser expands until it is the same size as the tail pipe *E*. This allows the air and noncondensible vapors which have been brought through the contracted throat *F* to expand, thus making it impossible for them to get back into the condensing chamber. They are, therefore, taken down through the tail pipe and delivered to the hot well.

The Westinghouse LeBlanc jet condenser is shown in another illustration. Steam entering the top of the condenser meets an incoming charge of water and is quickly condensed; it falls to the base of the condenser and is removed by the centrifugal discharge pump, the noncondensible vapors being ejected through the medium of the LeBlanc pump. The condenser body of ample proportions is made of close-grained cast iron, the upper portion of the body forming an annular channel for distributing the circulating water through several nozzles into the condenser. A much faster and at the same time a more intimate mixture of steam and water takes place with the subdivision of this incoming water than if the total quantity of water were passed into the condenser through a single opening. A very powerful breaker is attached to the condenser body and serves to break the vacuum in case of accident to the pumps, thus preventing water

from rising above the top of the condenser and putting it out of service.

Circulating and air pump casings are placed directly beneath the condenser body, and in addition to housing the pump runners serve the purpose of supporting the condenser. In order that either pump may be removed with convenience and dispatch without disturbing the other the casings are made separately, hand holes also being provided on each pump to facilitate inspection.

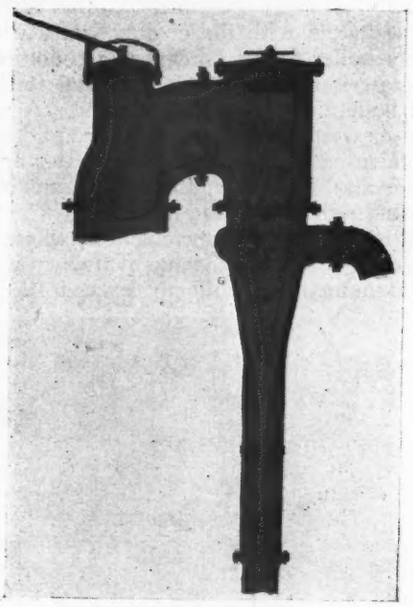
In the Roturbo rotary jet condenser the mixture of steam and water is secured by means of a revolving impeller. After the water jets have traveled rapidly some distance so that the broad parts of the water fans have all combined to form a complete ring of spray, and condensed the steam, the problem, as in the case of all other condensers, is to extract the condensate and air with certainty and efficiency. It is at this point that this condenser differs in principle from all other types. Instead of giving the water jets, as they leave the injection nozzles in the drum, sufficient energy to extract themselves from the vacuum chamber and carry with them without further assistance the air and condensate, or instead of letting the condensate accumulate in the bottom of a large condenser chamber where the air is separated and from which the air and water are independently extracted by auxiliary apparatus, the rotating jets of spray or condensate with the entrained air are picked up by the blades of an exhaust fan concentric with the rotating pressure drum and of a larger diameter and are ejected with certainty and efficiency.

Characteristics of Surface Condensers and Method of Operation.

Surface condensers consist essentially of a cast iron shell provided with a tube set in each end, into which brass tubes are expanded. The exhaust steam fills the shell and passes around and between the tubes, while the cooling water is forced through the tubes by means of a circulating pump. Contact with the cool tubes condenses the steam and the condensate drops to the bottom of the condenser from which it is exhausted. A Wheeler condenser, which is fairly representative of the best type of surface condenser, is shown in an accompanying illustration. In the Alberger condenser, which is not illustrated, the steam enters through a deep rectangular steam distributing dome, extending nearly the full length of the condenser shell. The sides of this distributing dome slope downward and become tangent to the main shell, leaving an arc of nearly 180 deg. of the tube surface exposed to the entering steam. The construction of this steam dome evenly and effectively distributes the entering steam over the full length and breadth of the tube surface and brings it at once into contact with the greatest possible number of tubes.

With regard to surface condensers the following points should be given care in choosing such equipment: (1) Upon entering the condenser the steam should encounter the minimum of resistance practicable, and the pressure drop through the condenser should be just as small as possible. (2) Rapid air removal and freeing from entrained water should be provided. (3) The condensate should be returned to the boiler and freed of air as rapidly as possible, and at as high temperatures as possible. (4) There should be as little obstruction as possible to the flow of the circulating water in all parts of the condenser.

As with other types of equipment, the choice of



View of Bulkley Injector Condenser, Showing Paths of Steam and Water.

a condenser for any given plant depends upon the individual conditions. Engineers differ somewhat in their estimate as to the volume which a condenser should have with reference to that of the engine cylinder with which it is connected, but a generally accepted figure is that the condenser volume should be 75% of that of the engine cylinder.

The general advantages and disadvantages of the different types may be briefly summarized as follows:

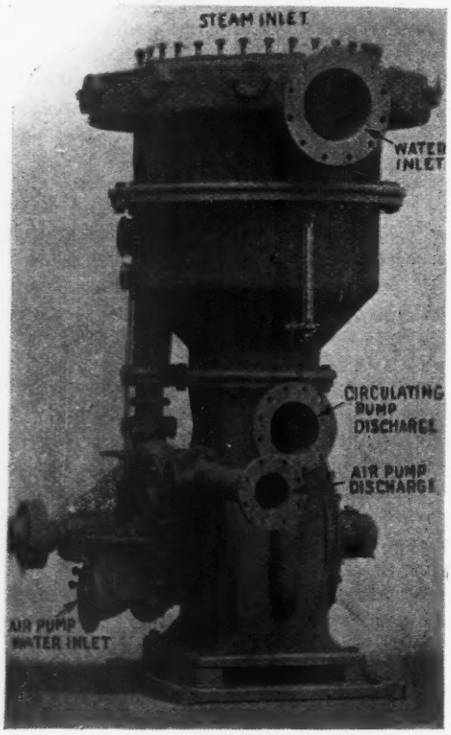
Jet condensers—Advantages.—(1) Least expensive to install. (2) Occupy very small space. (3) Installation does not require hot-well pump. (4) Cost of maintenance low. (5) Requires less water than surface condenser. (6) Acidulated or otherwise impure water may be used. *Disadvantages.*—(1) Condensate is wasted. (2) Failure of apparatus might flood turbines.

Surface condensers—Advantages.—(1) Condensate can be used for boiler feed. (2) Better vacuum obtainable. (3) Low pumping head. (4) Less chance of losing vacuum because a drop in vacuum does not affect water supply. *Disadvantages.*—(1) High initial cost. (2) Comparatively high cost of maintenance. (3) Large floor area required. (4) Acidulated or impure water cannot be used.

Barometric condensers — Advantages.—(1) First cost reasonable. (2) Low cost of maintenance. (3) No danger of flooding turbine. (4) Acidulated or impure water can be used. (5) Requires less circulating water. (6) No hot-well pump required. *Disadvantages.*—(1) Possibilities of air leaks in long exhaust pipes. (2) Loss of vacuum between condenser and turbine amounting to 0.5 in. or more. (3) Construction not adapted to building plan of many engine rooms. (4) Condensate is wasted.

Where there is a supply of water suitable for cooling purposes and for boiler feed the jet condenser is most suitable. When the cooling water is not good for boiler feed, and the separate supply of boiler feed is expensive, the jet condenser is not so desirable inasmuch as the condensed steam is mixed with the cooling water which is unfit for boiler feed. Under such conditions the condensate is lost, so that a continual fresh supply of boiler feed must be procured. A surface condenser would be better for this condition since the condensed steam and cooling water are kept separate and, therefore, the condensate may be saved and returned to the heater.

With the low-level jet condenser, where water enters the condenser by virtue of its own vacuum, the maximum lift should not exceed 18 ft. and



Westinghouse Le Blanc Condenser With Inlet Openings at Top of Shell.

the minimum should be not less than 6 ft. If the cold well cannot be located near the condenser the greatest care must be exercised to see that all water lines are perfectly air tight. The amount of water required for the air pump is approximately 15% of that used for condensing purposes, that amount, as a general rule, being discharged to the hot well.

A head of any more than 10 ft. is the maximum against which the air pump is able to discharge; hence, with cooling towers or spray pond installations the air pump discharge must never be led into the main condenser discharge. Pipe lines should be as short and as free as possible of air, thereby reducing friction losses to the smallest possible amount. Also it is best to use long-radius elbows and avoid tees, using flanged pipes on all lines subject to vacuum.

The quantity of water used by the air pump should be regulated by a gate valve, and a check valve should be provided in the air-pump discharge line to prevent a return flow. With turbine-driven condensers a good valve should be provided in the steam line next to the governor valve on the turbine, and a drain should be provided for this valve. An expansion joint should be installed on the exhaust line over the turbine in order to prevent pipe strains which may cause the turbine to get out of alignment with the pumps. With motor-driven condensers the motors must be protected from water. It is advisable to use low-voltage motors with impregnated windings as a protection against moisture.

The best arrangement for a barometric condenser is one where the level of the cold well is not greater than 18 ft. below the center line of the injection opening on the condenser. With this arrangement the circulating pump is unnecessary. Avoid long horizontal lines. Make exhaust lines as large in diameter as possible, thus reducing pressure drop to a minimum. Provide exhaust pipes with atmospheric relief valve. The injection line should be provided with a gate valve for regulating the amount of water used by the condenser. Another gate should be provided in the air line between the air pump and the condenser.

Study the arrangement of steam paths into the tube bank. The lower tubes are surrounded with films of water and dense air which seriously impede the flow of heat. See that your condenser tubes are kept clean. With dirty tubes the rate of heat transmission is greatly reduced and the vacuum is insufficient for the efficient operation of the prime mover. Do not buy a smaller condenser than you need. A uniform high vacuum over operating periods is worth far more than the initial investment saved by reducing the tube surface.

NEW ELECTRIC PLANT AT NANKING.

Owing to the inability of the existing electric plant at Nanking to furnish sufficient current to meet the needs of the city and its riverside suburb of Hsiakwan, a new plant has recently been added. The plant complete, exclusive of the site, cost the equivalent of $125,000 American currency. The generator is an American-made turbogenerator producing a 2300-volt, 3-phase, and 60-cycle current with direct-connected exciter. The boiler-feed pump and supply pumps are of American manufacture. The feed-water heater is also American, as is the 4 by 5-in. vertical steam engine used for the stoker drive. The building for the new plant was erected by the Nanking Electric Light Co. under the supervision and according to the plan of an American-educated Chinese engineer. The installing of the machinery has been done by an American engineering firm.

ELECTRIC SHOVELS—A CORRECTION.

The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has called attention to an error in the article entitled "Electric Shovels in Construction of a Power Canal" appearing in the Sept. 3, 1921, issue of ELECTRICAL REVIEW. The Cutler-Hammer Manufacturing Co., Milwaukee, supplied the control apparatus for the Bucyrus shovels, instead of the Westinghouse Electric & Manufacturing Co., according to the information now at hand.

EDITORIAL COMMENT

Converters of the Future

For many years electrical men have endeavored to simplify and perfect apparatus for the conversion of alternating-current energy into direct-current energy. They have also sought to reconvert direct current as well. Motor generators, rotary converters, mechanical and electrolytic converters and mercury rectifiers have been developed and manufactured, but the ideal device for the economical conversion of energy in quantities has not as yet been perfected.

Albert W. Hull of the General Electric Co., Schenectady, N. Y., in the current issue of the *Journal* of the American Institute of Electrical Engineers, describes the "Magnetron" tube, a new member of the electron tube family, and predicts for it a future that should make it an ideal converting device on a large scale. In discussing the applications of the new device he described its future in the field of radio communication and then took up the question of use in the power field. His comments were as follows:

"The field of radio is insignificant, however, compared with that of engineering, and it is in engineering that vacuum tubes will find their most important applications.

"One of these applications is the use of magnetrons as lightning and surge arresters. The magnetron is connected in multiple with the machine to be protected, and the magnetic field is adjusted so that no current flows through the magnetron under normal conditions. If the voltage rises above normal, however, as soon as it reaches a definite predetermined excess the magnetron valve opens wide, allowing very large current to flow, but closes again as soon as the voltage falls below this same value. The time lag in the tube is nearly zero, manifold smaller than in the sphere gap, and the magnetron may find applications where this speed is important. . . .

"I have pointed out some of the applications for which the magnetron is especially adopted. There are many other applications for which vacuum tubes are suitable, and for which one may confidently predict they will be used. Their capacity is ample. . . . One may predict that one year will see these tubes in use as kenotron rectifiers for series arc lighting. Five years will see them in substations replacing synchronous converters. In 10 years they will be on electric locomotives, either as rectifiers, allowing the use of d-c. motors or as variable-frequency alternators, taking their power from a high-tension d-c. trolley line. Twenty years will see d-c. transmission lines fed through transformers and kenotrons at any convenient points, by alternators of any frequency, and tapped by the same tubes acting as magnetron alternators or some equivalent pliotron or combination vacuum-tube alternator.

"The power capacity of tubes is ample for these purposes. Electron devices are not small inherently; they are only young."

The Central Station and the Department Store

There are but few types of business available to the central station that provide a more uniform and steady block of load than that provided by the illumination of department stores. That central station managers have not given this particular question the full measure of attention which it merits has been amply demonstrated. A survey of store lighting, made some months ago and reported at the time in ELECTRICAL REVIEW, demonstrated beyond a doubt that there was great need of improvement in even the most modern of department stores. This survey also showed that store managers were anxious to improve their lighting. In fact, the stores examined almost immediately increased their use of energy for lighting.

In this issue of ELECTRICAL REVIEW appears the second half of an article by A. L. Powell dealing with the practical problems of department store lighting. The first half of the article appeared in the Lighting issue of Sept. 10, 1921. The article relative to the survey already mentioned appeared on p. 251 of the Lighting issue of Feb. 12, 1921. Particular attention is called to these articles, and to the proposition in general, at this time because of the fact that the winter lighting period is rapidly approaching and the well-lighted store will be the one to secure the cream of the winter's business. The central station manager or lighting salesman who can point out these conditions to the store manager is bound to make a pleased and profitable customer of one who may have previously been interested only in reducing the bill for service.

What the department store wants in illumination is a condition that will make an attractive appearance, speed up sales, and be safe and comfortable to the public and the employes. If the electrical industry fails to provide such a condition the cause can only be laid at the door of neglect, for the store manager will buy any device

or service that will produce business. Every central station man who has not already done so should go over the list of stores in his territory and should make a case for better lighting with every one now below the highest standard. If you fail to make a convert to the cause of better lighting, review your own methods and arguments to find wherein the fault exists.

Power Plant Design and Labor Costs

The problem of reducing the cost of attendance in the modern power plant is second only in importance to that of fuel economy. A close study of the operating conditions in plants of various sizes indicates that too little attention has been paid to the relation between station design and labor cost, and that many installations otherwise excellent are handicapped by arrangements of equipment and types of apparatus which are anything but efficient. The central station industry as a whole needs more information than it now possesses upon the actual payroll requirements of different sizes and types of plants, and a thorough investigation of the subject would be most timely. Such a study might well include skeleton plans of a large number of stations of the steam and hydroelectric type, tabulations of the number of attendants required in each section of the plant, log sheets showing the hours of service of each man on a representative day, the times of starting different generating and auxiliary units, and the variations in load from hour to hour. Rates of pay might profitably be included for each class of station service and, in general, the same sort of analysis could be made that an efficiency expert carries forward with respect to factory labor.

Any such study as this is found to disclose many weak points in design and operation which can be remedied in future practice. Some of these may be mentioned at this time. The factor of available operating space is one of the most important, and closely associated with it is the location of auxiliaries with respect to prime movers. In order that the attendance shall be reduced to the safe minimum per shift every piece of machinery in the plant must be accessible—a simple requirement in the abstract, but exceedingly difficult in the concrete. Overhead cranes must cover the total installation in charge of the operating engineer, and the spacing between all main and auxiliary units should permit the quick removal of the largest single piece subject to emergency repairs and replacement. The location of auxiliaries in bays out of reach of the crane adds far more to the cost of repairs than is usually realized, on account of the time lost in transferring heavy parts to and from the machine sites. Again, the crowding of pipes and valves to save a few hundred dollars in building cost tends to increase the labor charges, and the inadequate lighting of basements, coal conveyors, crusher houses or pits and pump rooms lengthens the time needed to inspect and maintain equipment. We all know the practice of lighting passageways between machinery foundations, condensers, pumps and heaters by single 16-candlepower lamps hung by flexible cord from the ceiling of the basement, the lamps being without reflectors of any kind and generally allowed to accumulate dirt and spattered oil for weeks at a time. A change is in sight in this branch of work and it has already gone so far in some engineering houses that every plant designed by these firms is provided with a complete set of lighting plans and elevations as well as with drawings of the piping, building sections and machinery layouts.

False economy in the design of power plant structures leads to excessive labor costs. In these days of reinforced concrete far better arrangements of machinery and plant equipment can be made for a given expenditure than in the old brick-and-steel period of 10 yrs. back. With skillful designing the floor levels can be made uniform; the switchboard can be carried at a commanding elevation when desirable, without serious expense for its supports, and ceiling spans can be extended enough to cut down obstructive columns to the minimum. It should not be forgotten that it will pay to spend several thousand dollars for a larger working area in the station for every man whose services can be dispensed with. The possibilities of overlapping shifts are also worth considering.

A Progressive Movement

There are certain sure signs visible that indicate a determination on the part of business to revive. Business will revive or languish as a result of its own attitude toward its own condition, and when it appears that business wants to live then it seems evident that business will prosper.

One of the signs of this determination to go ahead is found in the keen interest now being taken in the available means of publicity. During the past few weeks there has been a very unusual number of requests received by ELECTRICAL REVIEW for extra copies or reprints of articles wherein some product has been mentioned or favorably commented upon. These requests simply mean that someone is going to go out after business with the grim determination of getting it.

It may be only a coincidence, but it seems worthy of comment that most of these requests come from people who have not been consistent

advertisers. It may be that this movement, for it seems as though it might be called such, is only an awakening of a few people to their opportunities, but it appears rather to be an evidence of the will of business to stand up and overcome its inertia.

Electromotive Force

It takes a long time for those who have not been able to give up some period of their lives to close study of science to distinguish between cause and effect; and even among those whose business it is to draw this distinction more or less confusion is frequently brought about by their dwelling upon the effect and approaching the subject from a study of this rather than attacking the problem from the other direction. Of course, in some cases this rear attack is necessary, but after the subject has been fairly well mastered better progress may be made generally by looking at it from the other side.

The desirability of taking up a subject in this way is not always realized, and instructors are prone to treat it chronologically rather than logically. They, for example, talk about an experiment with currents, directing the student's attention to them, and only after he has more or less familiarized himself with phenomena accompanying an electrical flow do they suggest to him the idea of electromotive force—of that which causes the current to flow. He has already grasped the idea of a difference of potential, and the new term at first seems unnecessary. How many of us have not been in this condition, when we first took up the study of electricity, and complained that the distinction which it was sought to draw was too fine; that the current flowed because there was a difference of potential, and that it was not necessary to go back of this idea. Of course, further reflection or still further study demonstrated how impossible it would be to talk or think clearly on electrical matters if no such distinction were made.

This difficulty in appreciating what is meant by electromotive force—that is to say, the cause of an electric flow—is frequently met with in discussions of a more or less popular kind in which the term seldom appears. Probably, as a general rule, no harm is done, particularly if the omission be not too glaring, but, on the other hand, the idea of this force is often essential to the proper understanding of the subject. This is true in discussions of behavior of electrical machinery of all kinds, and particularly so when the apparatus being considered is a motor. We may talk about the performance of a dynamo fairly satisfactorily if we state merely that the driving around of the armature causes a current to flow, but when it comes to an examination of the performance of a motor we soon get into trouble if we do not explain clearly that the very motion of the armature of the motor sets up a force which opposes the flow of current through it.

No work can be done unless we overcome some force. In the dynamo we may say that the current flowing through the armature resists its rotation. But what resists the flow of current through a motor's armature, and what controls this rate of flow? These are questions which meet one at the very start, and until some satisfactory explanation is adopted no intelligent progress can be made. If the student will bear in mind Faraday's laws governing the action of a magnetic field on a conducting body—that is, that relative motion will set up an electromotive force, a force which tends to cause a current to flow—and Lenz's law, which is really a corollary of the law of the conservation of energy, that the reaction of an effect opposes the cause, he should have little trouble. When a current is allowed to flow through a dynamo armature the magnetic forces set up by it oppose the mechanical motion; so, in a motor, if the armature be allowed to revolve when a current passes through it this motion will set up an electromotive force which will oppose the flow of current — the so-called counter-electromotive force. A dynamo is a source of current; hence the electromotive force set up in it acts with the current. A motor is a consumer of electrical energy; therefore the electromotive force set up in it must oppose the current flow. These relations seem simple enough, yet almost every day one meets with evidence that they are not understood.

Tests at 1,000,000 Volts

The announcement of the fact that experiments and tests are being conducted with equipment working under a pressure of more than 1,000,000 volts should cause the men of the electrical industry to stop for a moment and consider just what such a thing means. At present a system of power distribution is being arranged in California to operate at 220,000 volts—by far the highest potential ever employed in commercial power work. With the performance of insulators and conductors actually determined up to five times the present limits of utilization it seems evident that the road is still open to the engineer for progress. Such data as may be gathered will make it possible to compute the dollars and cents possibilities of higher-voltage projects with assurance that the engineering computations are based on facts and not supposition. It is just such a progressive engineering spirit as this latest announcement characterizes that has made the industry what it is. A progressive business spirit will care for the future.

THE WEEK'S NEWS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

A. I. S. E. E. TO MEET IN CHICAGO NEXT WEEK.

Some Recent Developments in Induction Motor Starting and Electrification of Steel Plant Railroads Among Subjects to Be Discussed.

"The Electrical Engineer in the Steel Plant and Out" and "Some Recent Developments in Induction Motor Starting" are among the important subjects to be discussed at the 15th annual convention of the Association of Iron and Steel Electrical Engineers to be held at the Hotel La-Salle, Chicago, Sept. 19-24.

The program prepared for the meeting follows:

Sept. 19, 9:30 *a. m.*—Business session and election of officers.

Sept. 19, 2 *p. m.*—Papers on "Some Recent Developments in Induction Motor Starting" by M. Spencer, and "The Electrical Engineer in the Steel Plant and Out" by F. B. Crosby.

Sept. 20, 9:30 *a. m.*—Papers on "Electrification of Steel Plant Railroads" by R. B. Gerhardt, and "Anti-Friction Bearings in Steel Mills" by A. M. MacCutcheon.

Sept. 20, 2 *p. m.*—Inspection trip.

Sept. 21, 9:30 *a. m.*—Fuel Economy Day; papers on "Fuel Requirements of Steel Mills" by F. E. Leahy; "The Control of Boiler Operation" by W. N. Flanagan; "General Use of Oxygen in the Steel Mill Industry" by E. A. W. Jefferies, and "Waste Heat Utilization for Steam Generation" by G. R. McDermott.

Sept. 22, 9:30 *a. m.*—Report of Electric Furnace Committee by E. T. Moore; report of Electrical Development Committee by R. B. Gerhardt; report of Educational Committee by L. F. Galbraith, and comments on Safety Committee Work by Walter Greenwood.

Sept. 23, 9:30 *a. m.*—Standardization Committee report by W. T. Snyder; electric overhead traveling crane specifications, by F. W. Cramer; report of Subcommittee on Illumination, by H. L. Kirschberg.

Sept. 23, 2 *p. m.*—Inspection trip.

Sept. 23, 7 *p. m.*—Fifteenth annual banquet.

RECORD ATTAINED IN GENERATION OF HIGH-VOLTAGE POWER.

Tests and Experiments Made at Commercial Frequencies With Conductors and Insulators Working at Pressure of 1,000,000 Volts.

Brief telegraphic messages received from Pittsfield, Mass., describe the successful generation of power at commercial frequencies at a pressure of 1,000,000 volts and above. One message reads substantially as follows:

"Successful generation of electric power at more than 1,000,000 volts, at commercial frequencies, has been accomplished at the high-voltage engineering laboratory of the Pittsfield Works of the General Electric Co. During the course of the experiments just completed much valuable data was gathered indicating the feasibility of considerably higher transmission voltage. Physical laws applying to high-voltage phenomena were found to hold good at these enormous potentials. In the course of the experiments the gap spacings for sphere and needle spark gaps were carefully checked up, and prolongation of existing curves (750,000 volts and below) were found correct up to 1,000,000 volts. Arc-over tests were made on strings of standard 10-in. suspension insulators up to 1,000,000 volts. The laws of corona were checked at similar potentials and found to hold. A short transmission line was tested for corona conditions, and results indicated that a line using 4-in. diam. conductor or larger would be necessary at 1,000,000 volts. The successful conclusion of the tests is the result of more than 30 yrs. of constant experimentation during which time transmission voltages have arisen steadily from the first 15,000-volt line built in Pittsfield in 1891 to the present record-breaking voltage of 220,000 volts, equipment for which was recently shipped from Pittsfield and is now being installed on the Pacific coast.

"Today's tests confirm the belief of the Pittsfield engineers that it will be commercially feasible to use considerably higher voltage in the transmission of power, and indicate the extension of long distance transmission beyond limits heretofore believed possible."

EDISON ILLUMINATING COMPANIES HOLD CONVENTION.

Economies of Electrical Merchandising and Inter-Relation of Power Systems Discussed at 36th Annual Meeting of Association.

Among the important subjects discussed at the 36th annual meeting of the Association of Edison Illuminating Companies held at Spring Lake Beach, N. J., Sept. 12-15, were the following: "The Economies of Electrical Merchandising" by George P. Baldwin; "Pressing Industrial Problems" by Magnus W. Alexander, managing director, National Industrial Conference Board; "Some Problems of Central Station Financing" by Lucien H. Tyng, vice-president, W. S. Barstow & Co., and "Inter-Relation of Power Systems" by John Price Jackson.

Samuel Insull, president, Commonwealth Edison Co., Chicago, in an able address on the development of the central station industry struck quite an optimistic note, his remarks being enthusiastically applauded by the 400 delegates in attendance. Clayton H. Sharp spoke on "Edison and the Art of Wireless Communication." C. J. Russell and T. W. Berger presented a paper on "A Study of Residence Kilowatt-Hours With Reference to Relative Consumption by Appliances and Lamps," discussion on which was opened by R. S. Hale.

The following committee reports were also presented: Standards Committee, by William C. L. Eglin, chairman; Metering and Service

Methods, by P. H. Bartlett, chairman; Electricity Distribution and Use, by L. L. Elden, chairman; Lamps, by J. W. Lieb, chairman, and Clarence L. Law submitted the report of the Subcommittee of the Lamp Committee on the survey of residential installations. Other committee reports were Steam Turbines and Generators, by H. P. Liversedge, chairman; Power Factor—further studies including survey of European practice, by C. J. Russell, chairman, and a symposium on various aspects of the fuel problem by M. S. Sloan, chairman.

Walter H. Johnson, Philadelphia, president of the Association, presided over the business sessions, the convention concluding with the election of the following officers: President, M. S. Sloan, Brooklyn Edison Co., and vice-president, John S. Gilchrist, Commonwealth Edison Co., Chicago.

Thomas A. Edison and Mrs. Edison motored over from Orange, N. J., Sept. 14, and were warmly welcomed by the many friends of the distinguished inventor. A film showing Edison inspecting the Edison Lamp Works and at work in his laboratory was exhibited by G. R. Morrison.

The entertainment features consisted of a reception to the delegates and guests Sept. 12 by the president, past presidents and their wives, which was followed by dancing. Recreation features were provided for the ladies during the business sessions, such as card parties, putting, croquet, tennis and golf tournaments. There was also a golf and tennis tournament for the men. The convention closed Sept. 15 with a banquet and dance.

PENNSYLVANIA ASSOCIATION HOLDS PROFITABLE MEETING.

Paper on "Super-Power Survey as It May Affect Pennsylvania" Discussed at 14th Annual Meeting of State Organization.

The Pennsylvania Electric Association—a state branch of the National Electric Light Association—held its 14th annual convention at Bedford Springs, Pa., Sept. 7-10. The program was carried out substantially as printed in the August 6 issue of ELECTRICAL REVIEW.

The proceedings were opened by the address of President Henry Harris, Wilmerding, Pa. Harold Goodwin, Jr., presented an interesting paper on "The Super-Power Survey as It May Affect Pennsylvania." The Technical Session was held Sept. 9 and the Accounting Session convened Sept. 10. The Public Policy Session held on the evening of Sept. 9 was addressed by many prominent speakers. At the commercial session many interesting papers and reports were presented. Altogether it was as profitable a meeting as the Association has ever had.

CO-OPERATION, KEYNOTE OF M. E. L. A. CONVENTION.

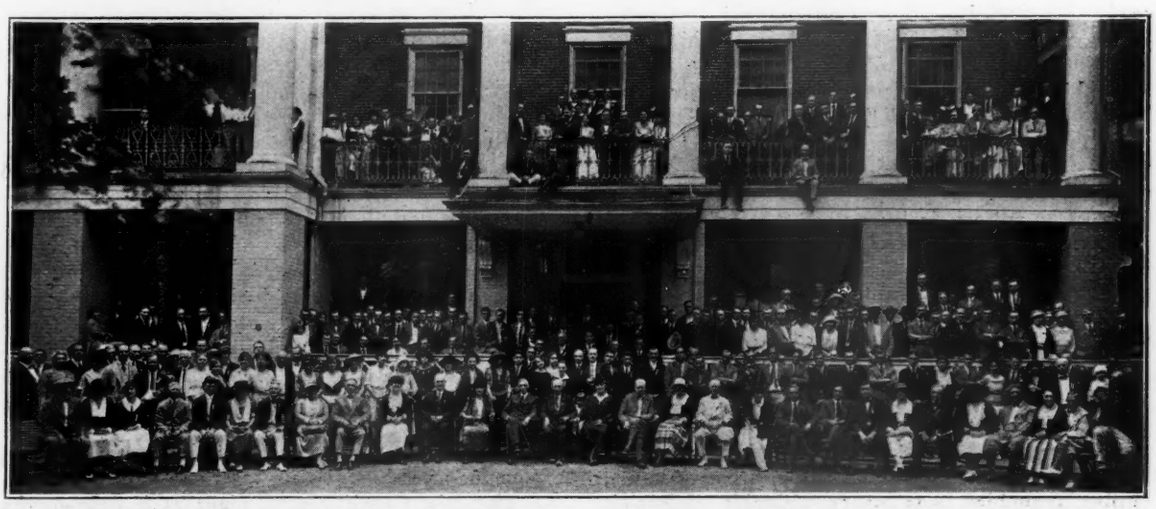
Codification of Public Utility Regulation Laws and Inductive Interference Problems Among Important Work Planned by Association.

The salient features of the recent convention of the Michigan Electric Light Association are summed up by Secretary Herbert Silvester as follows:

The meetings were given over to matters of a general nature, all technical and accounting papers and discussions being diverted to the geographic division convention which will be held at French Lick Springs, Ind., Sept. 21-23.

President G. E. Lewis of Ann Arbor, Mich., reviewed the activities of the state association during the past year, calling attention to the work of three important committees, namely the Committee on Public Utility Information, the Committee on Rural Extensions and the Committee on Safe Wiring. In making his recommendations for the coming year he pointed out that the keynote should be co-operation, working together of the various co-related interests, such as contractor-dealer and central station, electrical inspectors and central station men, and the various state and municipal bodies and the central stations.

Milan R. Bump, president of the National Electric Light Association, very optimistically stated that the electrical industry as a whole is in a better financial condition today than any other big national industry. The reason he gave for



Delegates and Guests in Attendance at the 14th Annual Convention of the Pennsylvania Electric Association, Bedford Springs, Pa., Sept. 7-10.

this condition was that where every other industry had practically oversold the market very few electric light and power companies had much surplus equipment lying idle. It was his opinion that the use of electric service today is about 10% of what it will be 10 yrs. from now, but in order to secure this development the industry must bring its needs home to the public so that securities will be sold and rates granted that will be adequate.

M. H. Aylesworth, executive manager of the National Electric Light Association, told of his experiences in bringing the services of the Association to the member companies. The work of the headquarter's office is constantly being extended so as to be of greater service to those members who cannot afford to pay for consultation regarding the various activities that the business involves.

A committee on women's education headed by Miss S. M. Sheridan, of The Detroit Edison Co., the codification of public utility regulation laws, publicity through moving picture theaters, coordination of the sale of securities with the investment bankers, and work with the American Telephone & Telegraph Co. in the matter of inductive interference, are among the important matters under way at the present time.

Stirring Message Delivered by W. L. Goodwin to the Delegates.

W. L. Goodwin, of the Society for Electrical Development, brought a stirring message to the Association. His theme was the working together of the various branches of the industry for the lasting and ultimate good of all. Dramatically, he enunciated this pronouncement: "As we merit the confidence of the public, or as we set up acts in the industry which discredit us in the eyes of the public the whole industry suffers. You cannot destroy any one part of the industry without eventually destroying all, and if we start the electrical industry in conflict within itself then it is only a matter of time until we are all through."

At the banquet Alex Dow, president of The Detroit Edison Co., very quaintly and picturesquely told of the history of his company in the relations with its customers. The three cardinal principles of success as laid down by him were: To do the fair and just thing in a way that will not bring offense to the customers; to avoid making promises unless those promises can be carried out implicitly, and to give service at all hazards. He warned against taking small matters to the commissions and courts for decision. "Let's have matches that will strike anywhere," he aphoristically stated. "We don't want to have to run to the state capital whenever we have trouble, when we can just as easily take the issue directly to the people."

W. W. Potter, of the Michigan Public Utilities Commission, predicted that unless the street car companies were given a fair return and assisted by the public in restoring the equipment and service that the street car would gradually disappear from our streets in the same manner as the horse did. It was his opinion that a public utility franchise was never valuable unless it was unjust, that is, if it was of value to the utility it was unjust to the municipality and if of value to the city it was unjust to the public utility.

James V. Oxtoby presented a paper on "Term Franchises in Michigan," in which he pointed out that most of the Michigan utilities are operating upon the assumption that at the end of their franchise period the franchise will be renewed and they will go on operating as before, but as a matter of law this is not the case. He said, "The logical and necessary result of a term franchise is to increase the cost of the company's service to those who are its customers or patrons during the franchise term. This is evident from the fact that the utility must amortize much of its investment during the franchise term and must be in a position at the expiration of the franchise to remove its property from the public streets, if required to do so."

The officers elected for the coming year are: President, J. K. Swanson, Jackson, Mich.; first vice-president, E. Holcomb, Alma, Mich.; second vice-president, S. B. Tuell, Houghton, Mich., and secretary-treasurer, Herbert Silvester, Ann Arbor, Mich.

CALIFORNIA HYDROELECTRIC PLANT READY FOR SERVICE.

Record Speed Made on Construction of Unit to Be Used Later as Supply Station for First 220,000-Volt Transmission Line.

Continuing its waterpower construction activities the Southern California Edison Co. completed on Aug. 12 its new 30,000-hp. Big Creek No. 8 waterpower plant on the San Joaquin river at its junction with Big creek. Although it would require under normal working conditions approximately a year to complete the construction of the power house building and install the apparatus, this work has been accomplished within a period of 3.5 mo. Three shifts of men, totaling 2000 on the average, and at times reaching as many as 2500, have been kept busy 24 hrs. a day on this job since ground was first broken early in May. The completion of the plant at this time removes all possibility of a power shortage this fall during the period when plants without storage reservoirs are operating at reduced production due to low stream flow.

In addition to its general stimulus to community activity the initial installation of the 30,000-hp. generator in this plant will conserve annually 530,000 bbls. of fuel oil. Its annual output will be 106,000,000 kw-hrs., with a value in the commercial power market of over $1,500,000. With the completion of this unit of 30,000 hp. the plant addition to the entire system completed during the present year will total 92,000 hp. Other plants brought in during the year were the Kern river No. 3 plant, rated at 40,000 hp., and the installation of an additional 22,000-hp. generator in Big Creek No. 2 plant. The additional plant capacity brought into production by the company during the year 1921 exceeds the capacity of the entire power installation on the Los Angeles aqueduct system by more than 20%.

The Big Creek No. 8 plant is a noteworthy installation because it is the first plant constructed on this system, and will probably be the first

plant in the world, to be put in operation utilizing a transmission pressure as high as 220,000 volts. The Southern California Edison Co. in conjunction with Professor Ryan, Leland Stanford University, has been carrying on extensive experiments with the purpose of perfecting its plans to convert the present Big Creek line from an operating pressure of 150,000 volts to 220,000 volts, and it is probable that operation at the higher voltage will be accomplished during next year. In the meantime energy from Big Creek No. 8 plant will be transmitted at 150,000 volts. Transformer equipment for the power house was purchased so that it would be possible to operate temporarily at 150,000 volts, and later on with the conversion of the Big Creek line to the higher electrical pressure to deliver the output from this plant at 220,000 volts. Increasing the voltage on the Big Creek lines from 150,000 to 220,000 volts will increase their capacity to transmit energy at a cost much below the duplication of another set of 150,000-volt transmission lines. Economy in transmission costs is the end to be accomplished by the conversion of the present Big Creek lines to the higher operating voltages.

LIGHTING FIXTURE SOCIETY WILL MEET IN MILWAUKEE.

J. L. Wolf, secretary of the Lighting Fixture Dealers Society of America, Builders' Exchange, Cleveland, has announced that the 1922 annual convention of the Society will be held during the Fixture Market in Milwaukee. Convention sessions will be held on the mornings of Jan. 30, 31 and Feb. 1 and 2. The morning sessions will end promptly at noon and the members will join at luncheon the Illuminating Glassware Guild and the National Council of Lighting Fixture Manufacturers.

CHASE TO ADDRESS INDIANA STATE ASSOCIATION.

At the annual meeting of the Indiana State Association of Electrical Contractors and Dealers to be held at the Claypool hotel, Indianapolis, Oct. 5-6, Samuel A. Chase, special representative of the Westinghouse Merchandising Bureau, will give an address on the subject of "Results of Harmonizing the Industry."

ELECTRICAL SERVICE LEAGUE OF SEATTLE HOLDS BANQUET.

A banquet and get-together meeting of those identified with the several branches of the electrical industry were held in Seattle, Wash., on the evening of Sept. 9, under the auspices of the Northwest Electrical Service League. The attendance of 100 comprised central-station men, contractors and dealers, jobbers and manufacturers and their employes.

R. W. Clark, of Puget Sound Power & Light Co., and chairman of the advisory committee of the League, acted as toastmaster. He said the organization of the League has brought together several groups of men whose purpose is to secure the co-operation of the electrical interests, to create good fellowship and co-ordination.

Stephen I. Miller, manager-secretary of the League, greatly interested the audience in a brief address. He predicted that the carrying out of the League's plans would require about 5 yrs. One purpose of the meeting, he said, was to enable the members to carry away with them the spirit of co-operation which is the life of the organization. He pointed out visible signs on the business horizon which are bringing about an optimistic outlook.

Professor Russell, who conducts a salesmanship class under the auspices of the League, told of the importance of training the individual salesman, and referred to the development of the co-operative spirit in the class room.

S. Hepler, president of the Washington Association of Contractors and Dealers, said that organization was functioning with good results, and discussed electrical inspection by both the Board of Fire Underwriters and municipal inspectors. He also referred to the fact that a new wage scale had been established without any friction.

Inspector Patten of the Rating Bureau of the Board of Fire Underwriters, opposed those regulations by which the use of electrical energy is restricted, and gave a classification of the causes of fire losses.

JULY ELECTRICAL GOODS EXPORTS SHOW DECREASE.

The exports of electrical goods to foreign countries for July were valued at $6,417,336, compared with $6,488,046 for the corresponding month of 1920, or a decrease of $70,710. For the 7 mo. ending July, 1921, the total exports amounted to $70,413,556, an increase of $17,160,953 over the 1920 figures and an increase of $15,810,168 over the total for the 7 mo. ending July, 1919.

The following classified figures give the detailed data for July, 1921, compared with the corresponding month for the previous year:

Electrical machinery and appliances (except locomotives):	July, 1920.	July, 1921.
Batteries	$ 497,657	$ 183,525
Carbons	119,309	29,317
Dynamos and generators	536,400	790,634
Fans	87,892	37,566
Heating and cooking apparatus	124,485	54,262
Insulated wire and cables	558,791	496,928
Interior wiring supplies, including fixtures	336,881	79,327
Lamps—		
Arc	2,004	.....
Incandescent—		
Carbon filament	5,303	10,802
Metal filament	244,010	153,689
Magnetos, spark plugs, etc.	304,702	85,173
Meters and measuring instruments	202,612	214,660
Motors	709,086	1,121,583
Rheostats and controllers	26,283	61,755
Switches and accessories	299,615	280,258
Telegraph apparatus, including wireless	33,150	39,107
Telephones	215,384	273,533
Transformers	165,728	788,719
All other	2,018,754	1,716,498
Total electrical machinery, etc.	$6,488,046	$6,417,336

EMPIRE ASSOCIATION WILL MEET NEXT MONTH.

The 17th annual convention of the Empire State Gas and Electric Association will be held at the Lake Placid Club, Lake Placid, N. Y., Oct. 6-7. In addition to the regular routine reports of the officers and committees, the following addresses will be delivered: "Public Relations as Factor in Value of Utility Securities," by H. M.

Addinsell, Harris, Forbes & Co., New York City; "Serving the Public" by Loyal S. Wright, Manlius, N. Y., and an address by William A. Prendergast, chairman, Public Service Commission.

The entertainment features consist of the annual dinner Oct. 6, with music furnished by the Con-Gas Quartette and motion pictures descriptive of "The Spirit of Service" and "Behind the Button." On Oct. 7 there will be held the Inter-Committee golf tournament.

BUSINESS MEN'S CONVENTION TO BE HELD IN CHICAGO.

There will be a meeting of the National Conference of State Manufacturers' Associations at the Congress hotel, Chicago, Sept. 29-30, to consider the industrial situation, giving special attention to congressional legislation, such as the tariff (including American valuation), taxation and transportation. The agitation as to the three subjects referred to must be settled before the country can enter upon an era of prosperity.

The convention is called at the urgent request of manufacturers generally and manufacturers' associations, with particular reference to pending legislation. Invitations are being extended to manufacturing organizations of the United States to send representatives and also to corporate and individual manufacturing firms. A well-considered program will be announced later for the 2 days' meeting. Every line of manufacturing business will be given an opportunity to be heard so far as is possible in the two days' session.

RHONE WATER-POWER PROJECT.

A report from Lyon, France, states that the legislation affecting the proposed combined hydroelectric, irrigation and navigation scheme for the Rhone river has been passed. The report goes on to state that this is simply the putting into legal form of the general plan embracing the principles of the project and the outlining of a scheme of organization, leaving the details to be handled by concessionaires.

WIRELESS CONTEST PLANNED FOR NEW YORK ELECTRICAL SHOW.

A world's championship speed contest in wireless telegraphy is to be held in New York City Sept. 28-30 in connection with the New York Electrical Show at the 71st Regiment Armory. The contest will be open to all comers and some of the fastest army, navy, and commercial operators are expected to take part. A silver cup, emblematic of the world's championship, will be presented to the winner. The contest will be held under the auspices of the National Amateur Wireless Association and will be conducted by a committee representing the government departments and the commercial telegraph companies. Entries, which close Sept. 29, may be made through the National Amateur Wireless Association, 326 Broadway, New York City. There is no entry fee.

In addition to the professional contest there will be a test in receiving messages through interference. This will be limited strictly to amateurs and it will bring out some of the best "home station" operators of the amateur radio clubs. Announcement of the two contests is being sent to wireless operators by wireless telegraph—the National Amateur Wireless Association broadcasting it through the air just as the Dempsey-Carpentier bulletins were sent out July 2. Besides the contests there will be very interesting displays of wireless apparatus, for practically all of the manufacturers have taken space at the show.

COMING CONVENTIONS.

Rocky Mountain Geographic Division of the National Electric Light Association and the Colorado Electric Light, Power and Railway Association. Joint annual convention, Glenwood Springs, Colo., Sept. 19-21. Headquarters, Hotel Colorado. Secretary, Minnie B. W. Baker, 900 Fifteenth street, Denver, Colo.

Association of Iron and Steel Electrical Engineers. Fifteenth annual convention, Chicago, Sept. 19-24. Headquarters, Hotel La Salle. Secretary, John F. Kelly, Empire building, Pittsburgh.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers. Annual convention, Huntington, W. Va., Sept. 20-22. Secretary, Herbert Smith, 212 Robson-Pritchard building, Huntington, W. Va.

Great Lakes Geographic Division of the National Electric Light Association. Annual convention, French Lick Springs, Ind., Sept. 21-23. Secretary, R. V. Prather, 305 De Witt Smith building, Springfield, Ill.

Indiana State Electric Association. Joint meeting with Great Lakes Geographic Division of the National Electric Light Association, French Lick Springs, Ind., Sept. 21-23.

Illuminating Engineering Society. Annual convention, Rochester, N. Y., Sept. 26-29. Headquarters, Powers hotel. General secretary, Clarence L. Law, 29 West 39th street, New York City.

American Electrochemical Society. Meeting at Lake Placid Club, N. Y., Sept. 29-Oct. 1.

New York Electrical Show, 71st Regiment Armory, Park avenue and 34th street, New York City, Sept. 28-Oct. 8. General manager, George F. Parker, 124 West 42d street, New York City.

Cleveland Section of the American Society of Mechanical Engineers. Great Lakes regional meeting, Cleveland, Oct. 3-4. James Guthrie, Fidelity building, Cleveland.

Indiana State Association of Electrical Contractors and Dealers. Annual convention, Indianapolis, Oct. 5-6. Headquarters, Claypool hotel. Secretary, A. I. Clifford, 507 Odd Fellows building, Indianapolis.

Empire State Gas and Electric Association. Annual convention, Lake Placid Club, N. Y., Oct. 6-7. Secretary, C. H. B. Chapin, Grand Central Terminal, New York City.

Indianapolis Industrial Exposition, Indiana State Fair Grounds, Oct. 10-15, under auspices of the Indianapolis Chamber of Commerce. Chairman, O. B. Iles, Chamber of Commerce building, Indianapolis.

Southeastern Geographic Division of the National Electric Light Association. Annual convention, Chattanooga, Tenn., Oct. 17-19. Headquarters, Signal Mountain Inn. Secretary, Charles A. Collier, Electric and Gas building, Atlanta, Ga.

Electrical Exposition, Auditorium, Milwaukee, Oct. 25-31, under auspices of the Milwaukee Chapter of the Wisconsin State Association of Electrical Contractors and Dealers, in connection with the Third Annual Food and Household Exposition, directed by the Milwaukee Journal.

National Council of Lighting Fixture Manufacturers. Annual convention and Lighting Fixture Market, Auditorium, Milwaukee, Jan. 30-Feb. 4. Secretary, Charles H. Hofrichter, 231 Gordon Square building, Cleveland.

Lighting Fixture Dealers' Society of America. Annual convention, Milwaukee, Jan. 30-Feb. 2. Secretary, J. L. Wolf, Builders' Exchange, Cleveland.

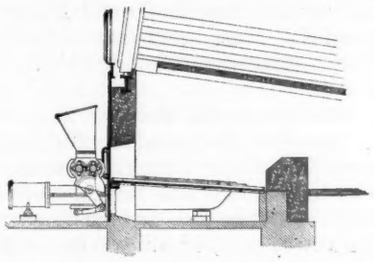
OPERATING PRACTICE

Methods and Problems Embracing Operation and Installation of Power-Plant Equipment and the Distribution of Electrical Energy

COAL CRUSHER INSTALLED AS PART OF AUTOMATIC STOKER.

Fuel Prepared as Used by Equipment Connected to and Operated by Mechanism Supplying Power to Stoker.

Many users of stokers are required at times to burn run-of-mine or other grades of lump coal, and many plants do not have coal crushing equipment to reduce the coal to a size suitable for the stoker. To meet such a condition and thus make every Jones stoker user independent of the size



Section Through Boiler, Setting, Stoker and Coal Crusher.

of coal which he purchases there has been produced a simple coal crushing device which may be attached to any Jones Standard stoker.

The crusher is the invention of practical stoker operators of the Amoskeag Mills, Manchester, N. H., and has been in use for over a year with gratifying results.

As shown in the accompanying illustrations, the crusher is installed immediately over the ram case, the coal hopper being raised about 18 ins. The two roll crushers are operated through a ratchet connected by a lever arm to the pusher rod below the ram case. The crusher operates only upon the return stroke of the ram, advantage being taken of the excess power available in the backward stroke of the ram. The forward stroke of the ram pushes fuel from the ram case

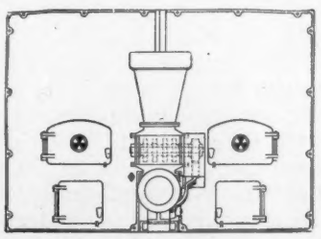


Diagram of Boiler Front With Crusher Installed Above Stoker.

into the retort in the furnace. On the rearward stroke a pawl engages the ratchet and the ram is made to actuate the coal crusher. The crushed coal drops down into the ram case to be forced into the retort at the next forward motion of the ram. Thus the coal is crushed as used and the power consumed by the forward and rearward motion of the ram is equalized.

Due to the agitation of the coal by the crusher any tendency toward bridging of the fuel in the hopper is eliminated. With the coal crusher attached to the hopper the coal is handled only once, being fed directly into the hopper where the device crushes it automatically as needed. No outside power for operation is required, as the power available in the rearward motion of the ram is utilized.

One of the advantages claimed for this equipment is that by crushing the coal as used immediately over the ram there is no tendency toward separation of the finer and the coarser particles of the crushed coal.

CONDENSER-WATER INTAKE USED IN SHALLOW STREAM.

Flat Horizontal Opening Takes Water From Near Bottom of River, and Duplicate Settling Basins Provide for Cleaning and Storage.

Steam power plants operate condensing to utilize the full energy of the steam by reducing back pressure and allowing maximum steam expansion, or for the recovery of the condensate. Usually both considerations are involved. Many plants experience difficulties in maintaining vacuum during the summer months because there is a shortage of water, because the water available is warm, or because it is dirty and foul. Often all these conditions exist at once so that maintaining high vacuum becomes difficult. This is the situation that existed at Aurora, Ill.

The Western United Gas & Electric Co's. generating plant on the Fox river uses river water for condensing purposes. The river is shallow at best and it is very shallow during the hot dry weather. Low water level means warmer water as well as a shortage of water, and other plants upstream tend to raise the water temperature. Low water level also means more dirt and filth taken into the pumps and condensers unless special precautions are taken to prevent it. These precautions become more difficult as the water level decreases, as there is a possibility of the intake tunnel standing out of the water at low water level. The Western United Gas & Electric Co. has overcome the problem in an interesting manner, as shown in the accompanying diagram. This arrangement enables the minimum water level to be utilized, and it minimizes troubles due to sewage, trash and debris carried down from the towns and factories upstream. It provides a large reservoir of water for use should the river water level go down excessively for short periods, as sometimes occurs; this same reservoir acts as a settling chamber for dirt in the water and at the same time allows the warm

river water to cool somewhat before it goes to the condensers in the plant.

The intake consists of four 24-in. sewer-tile pipes that go out into the Fox river almost 70 ft. These four pipes pass into a concrete tank or box measuring 6 ft. wide and 16 ft. in length. This intake chamber is located about 1 ft. above

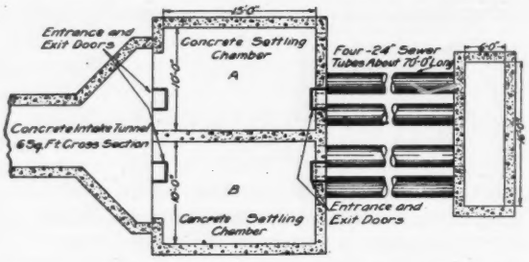


Diagram Showing Construction of Condenser-Water Intake Used in Shallow Stream.

the bottom of the river and is protected on top by iron grids 1.5 in. apart, each bar measuring 1 in. in thickness and 1.5 in. in depth. These grids are periodically cleaned by raking. The water is so shallow that a man can wade out to the intake at all times of the year.

All four sewer pipes enter concrete settling chambers on the river bank. There are two of these, each measuring 10 ft. square and about 15 ft. deep. These settling chambers are so located that about 4 ft. of chamber exists below the normal flow of water into which silt and other matter in suspension can settle. Each settling chamber is fitted with doors at entrance and exit which may be closed at any time to isolate either chamber, condensing water passing to the power plant through the other settling chamber when one is closed off for cleaning. As a matter of fact, there is sufficient water storage in the large concrete tunnel between the settling chambers and the condensers to allow the plant to operate for a considerable length of time with both settling chambers closed. The concrete tunnel from the settling chamber to the condensers is about 170 ft. long and has a cross-sectional area of 6 sq. ft. This is equivalent to a water storage capacity of more than 1100 cu. ft.

The settling chambers are periodically cleaned out in a very simple manner. The doors of the chamber to be cleaned are both closed. The top covers are then removed and a pump is lowered down to the bottom of the chamber. Before the pump is started the silt that has collected at the bottom of the chamber is agitated. The pump is then started and the silt pumped out.

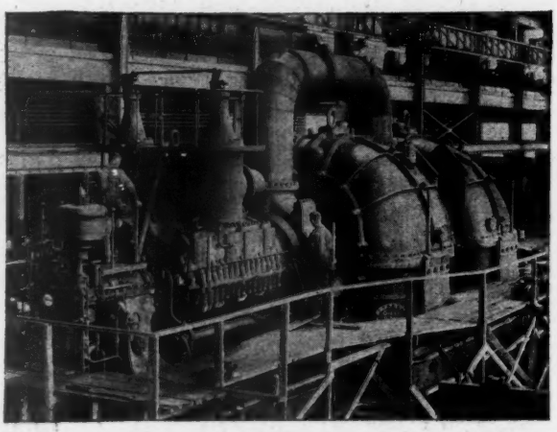
With such an intake tunnel the Western United Gas & Electric Co. is able to utilize minimum water level with the least trouble due to dirty water. During dry weather there is often not more than 1 ft. of water above the intake chamber, so that were the intake less advantageously located trouble would be experienced. The sewer pipes and the concrete tunnel are both arranged for water to enter by gravity and pass up to the plant with minimum friction. The company is using jet condensers because of the condition of the river water, although the lower cost of the jet type over the surface type was also a factor. The condensing water and condensed steam is discharged well down the river so as not to warm the water entering the intake tunnel.

TURBINES AGGREGATING 164,000 KW. TESTED AT ONE TIME.

Several Machines Rated at 25,000 Kw. or More Being Completed in One Shop—New Equipment Built for Several Different Companies.

The capacity of the testing room of the South Philadelphia works of the Westinghouse Electric & Manufacturing Co. was taxed to capacity recently when 164,000 kw. of steam-turbine generators were on the test floor at the same time. Nearly 150,000 kw. of this amount was made up of five turbines for some of the largest power companies in the United States. These large units include one 35,000-kw. turbine for the Hell Gate station of the United Electric Light & Power Co. of New York, one 25,000-kw. turbine generator for the Gold street station of the Brooklyn Edison Co., one 25,000-kw. turbine for the Virginia Power Co., Cabin Creek, Va., one 35,000-kw. turbine for the Calumet station of the Commonwealth Edison Co., Chicago, one 25,000-kw. turbine for the United Electric Light Co., Springfield, Mass., and one 10,000-kw. turbine for the American Rolling Mills, Middletown, O.

Other turbines on the floor at the same time include a 3000-kw. low-pressure turbine for the New Jersey Zinc Co. at Franklin Furnace, N. J.; a 1000-kw. turbine for the Tupelo Cotton Mills, Tupelo, Miss.; a 1000-kw. turbine for the Mobile Light & Railway Co., Mobile, Ala.; a 2000-kw.



View of a 35,000-Kw. Turbine Being Tested in Manufacturers' Shop.

house turbine for the United Electric Light & Power Co., New York City, and a 2000-kw. turbine for Takata & Co., Japan.

The 35,000-kw. tandem compound turbine generator for the Calumet station of the Commonwealth Edison Co., shown on test in the accompanying illustration, took 12 cars to carry it to Chicago. This turbine generator after being tested at the South Philadelphia works was delivered and is now being installed at the Calumet station.

Gas and electricity being among the most important essentials of every-day life, it is reasonable that the bond issues of companies dealing in these necessities should attain a secure position as economic conditions return to a normal basis. —*Wall Street Journal.*

COMMERCIAL PRACTICE

New Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

HOW PUBLIC UTILITY ENCOURAGES BETTER WINDOW DISPLAYS.

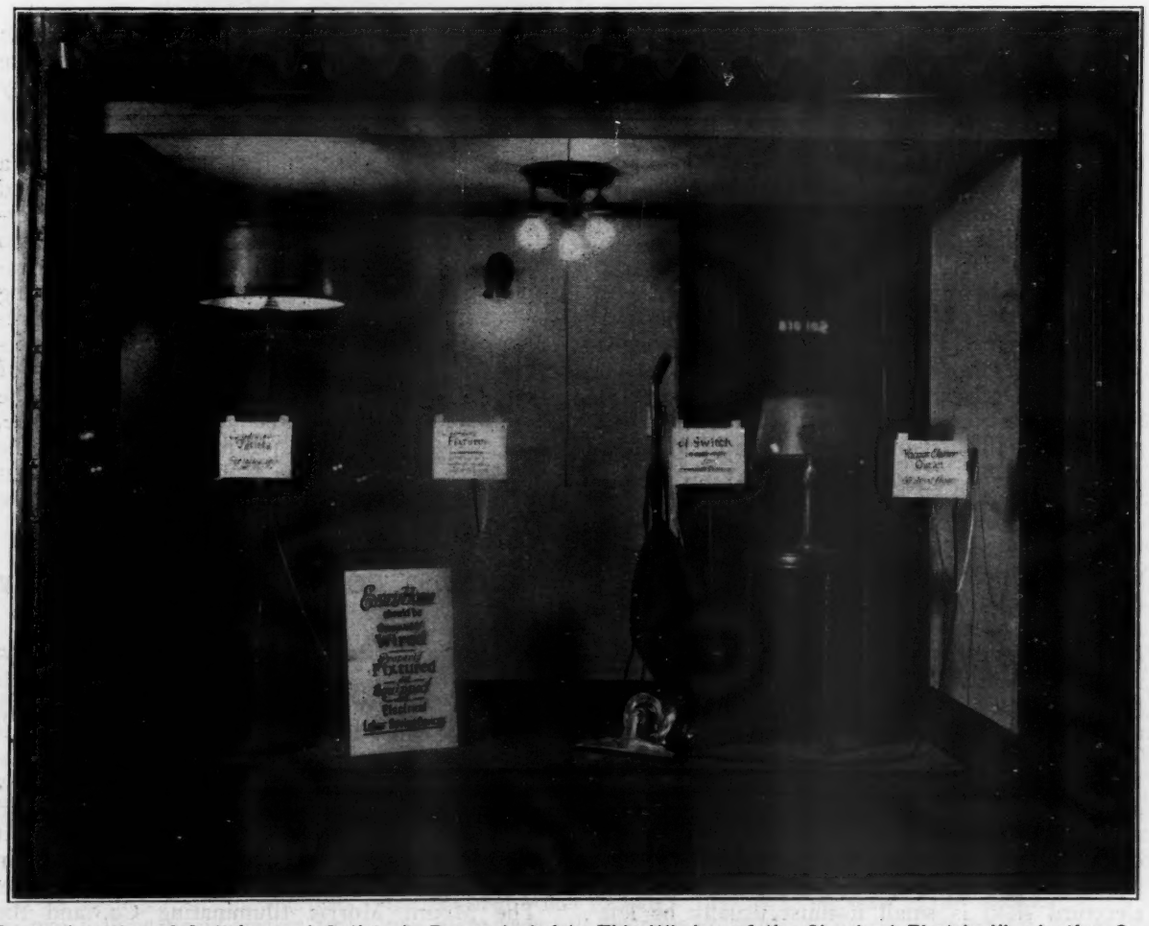
In Cleveland a "Community" Window Display Man Aids Electrical Dealers—Cleveland Electric Illuminating Co.'s Plan Meets With Success.

"Electrical merchants generally should give more thought to the appearance of their shops, and especially their windows. The average contractor-dealer is just learning that he must keep his store in better trim than the plumbing shop around the corner if he is to attract customers." So says C. B. Moore, a Cleveland display man who is engaged in dressing windows for a group of electrical stores.

In Cleveland the central station, the Cleveland Electric Illuminating Co., in its role of foster parent and general adviser to all the electrical appliance trade, not long ago hit upon the happy plan of inducing a professional to take responsibility for the appearance of the windows of a large group of electrical dealer clients. Mr. Moore was employed by the display department of a large woman's wear store when J. E. North, commercial agent of the Illuminating company, invited him to go into business for himself with the electrical retailers as his customers. Together these two made a canvass of dealers and presented to each a proposition by which Mr. Moore was to take over the window trimming of the store on a contract basis at so much per window, or—as the arrangement was later modified—at so much per square foot of window space. The dealers signed up, most of them with eagerness, Mr. Moore resigned from the department store in favor of the new work, and the results were soon apparent in the form of improved displays.

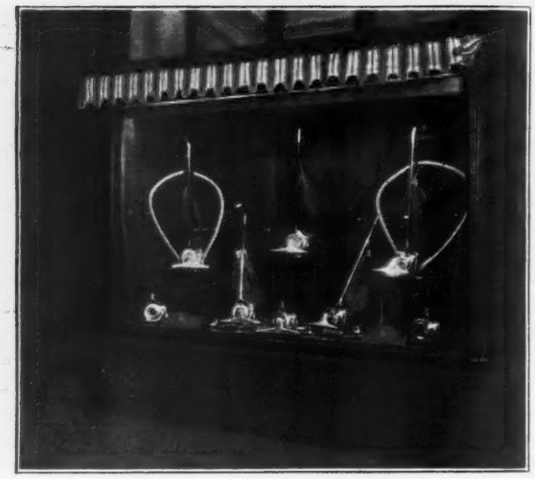
The process of educating the retailers regarding the value of artistic windows is by no means completed as yet, Mr. Moore declares. He says that most contractor-dealers are reluctant to provide equipment for setting up a good looking display, but still he finds among them a growing disposition to appreciate what an asset an attractive appearance may be to an electrical store.

"There is no reason," said this "community" window man, "why the windows of electrical



Proper Location of Switches and Outlets Is Demonstrated in This Window of the Cleveland Electric Illuminating Co. to Give Publicity to the "Electrical Home" Idea.

shops should not be as handsome and as great a drawing card as are those of large department stores and other successful specialty shops. Of course some experience in window dressing is necessary on the part of the person who undertakes such work, and it must be thoroughly understood that he must have proper equipment to work with.



Example of Well-Constructed Display Which Gets Its Message Across in Striking Fashion.

"To start out, all that is absolutely necessary is a few wooden pedestals on which to place objects to be displayed, and a few yards of velour to use as drapes to soften the background. It is really ridiculous to try to trim windows with crepe paper for decoration, for it is so flimsy and perishable that in the course of a year one may spend on it more than the cost of the velour, and have nothing left to show for the expenditure. And then, too, its appearance is poor and cheap."

The window speaks for the store, as Mr. Moore points out, and it behooves the merchant to see that it represents him creditably. For a really fine store "front," such as the electrical shop should have, the requisites are simple, according to Mr. Moore. The most important feature, correct window lighting, is strangely lacking in a large proportion of electrical men's windows. Dealers who preach the gospel of good lighting to others assiduously, frequently neglect it altogether in their own shops.

Attention Should Be Given to Covering of Window Floor as Basis for Display.

With adequate lighting installed, the next item to receive attention is the floor. "In many an electrical shop the window floor is badly scratched and marred as a result of moving washers, ironers, ranges and other heavy devices in and out," said Mr. Moore. "The best plan is to have the floor completely covered with a rug of one tone, a neutral, unobtrusive gray or brown preferably. This forms an ideal basis for any display."

Small pedestals and a taboret are needed, all of similar finish. Whether oak, mahogany, walnut or some other wood is chosen, it must be carried out uniformly and should harmonize with the surrounding woodwork. When the window of an electrical shop is small it must usually be left open at the back, for convenience in placing large appliances, such as washers and ranges, on display. Larger windows should be provided with a full background, however, Mr. Moore maintains, since this serves to focus the attention upon the goods.

"Merchants sometimes think that it is a good thing to leave the window open so as to show the store to passers-by," he said, "but this proves to be poor policy, for when anyone stops to look in the window his attention is immediately distracted to the movements of a clerk and customer in the shop and he turns away without really seeing what was in the window."

Colors are an asset in any window, but they must be carefully used. It has been shown by experiments that dark tones such as purple are best to set off electrical hollow-ware with its nickel finish. Black velour makes an effective drape for this purpose, for the percolator or grill gleams brighter than ever by contrast. Daring colors are best avoided, lest they may detract attention from the objects on display.

Mr. Moore's methods of window trimming are exemplified not only in the shops of a score or more of dealers, but also in two windows in the building of the Cleveland Electric Illuminating Co., prominently located on the public square. These windows the central station lends to dealers in rotation. Each electrical store in the city is represented here for periods of 3 days at a time.

Years ago the Illuminating company, as it is familiarly known in Cleveland, sold electrical appliances in competition with the dealers. "But we found," said Edward Nieder of the sales department, "that it was much better for us as well as for everyone else, to co-operate with the trade and boost the sale of appliances generally throughout the city than to carry on a business of our own in this line."

The first step in this direction was to evolve a plan of financing contractors, which was carried out most successfully. The newspaper advertising of the central station was then devoted to promotion of appliance sales, the window trimming project was launched, and the Illuminating company gave its hearty support to the comprehensive electrical development campaign with its aim of educating both the public and the men of the industry, which is now under way under the leadership of the Cleveland Electrical League. The policy of co-operation has been found to be a winner in Cleveland. Not the least important of its results is seen in the work of Moore, the "community window dresser."

GENESEO COMPANY OPERATING BY STEAM.

In regard to an item which appeared on p. 335 of the August 27, 1921, issue of Electrical Review, relative to the Geneseo (N. Y.) Gas Light Co., in which it was stated that the company has discontinued electric service permanently, William E. Hill, manager, writes as follows: "The Geneseo Gas Light Co. buys current from the Mount Morris Illuminating Co. metered at Cuylerville, and is still generating by steam in Geneseo part of the current used in that village. The Mount Morris Illuminating Co. and the Geneseo Gas Light Co. are two separate companies."

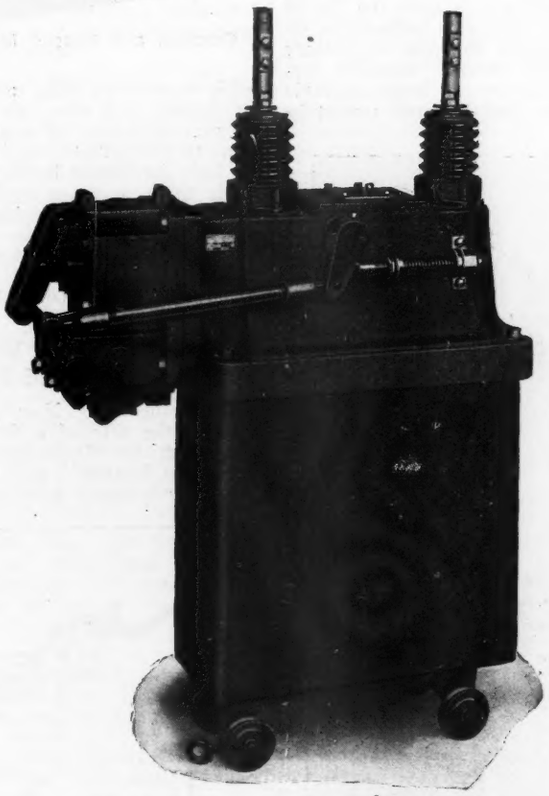
APPLIANCES and DEVELOPMENTS

New, Improved or Interesting Electrical and Mechanical Apparatus and Devices, and Applications of Equipment and Methods in Practice

Removable-Unit Type Oil Circuit-Breaker.

To meet the demand of central stations for a high interrupting capacity circuit-breaker of the removable-unit type, to replace breakers inadequate to handle the existing interrupting capacity of a station, the Condit Electrical Manufacturing Co., South Boston, Mass., has placed on the market the type F-10 oil circuit-breaker.

It is stated that it is very compact and can be installed in almost any cell formerly occupied by an oil circuit-breaker having an interrupting capacity between 1200 and 2000 amperes per phase at 15,000 volts. As the interrupting capacity of the type F-10 oil circuit-breaker is 10,000 amperes per phase at 15,000 volts, this allows central stations to increase the interrupting capacity of their equipment from five to eight times.



Type F-10 Condit Oil Circuit-Breaker.

As these circuit-breakers are not supported from any cell structure it is only necessary to install the tracks on the cell floor. No overhead framework is necessary and, in general, no change is required in the masonry, busbars, or connections to the circuit-breaker. This type of construction provides for quick renewal and efficient service at a low installation cost.

Some of the important characteristics of the type F-10 oil circuit-breaker are: High speed of operation, small space requirements, low cost of installation, a large steel expansion chamber, an oil tank 0.25 in. thick, a strong insulator brace connected to the frame, and current carrying members so related as to withstand the thermal and electromagnetic stresses encountered in large distributing systems.

Type F-10 oil circuit-breakers are built in rated capacities from 500 to 1200 amperes at 15,000 volts, and 500 to 800 amperes at 25,000 volts, single-throw, and can be furnished for single or multiple operation.

New Schedule on "Eveready" Flashlights and Batteries.

The American Eveready Works of Long Island City, N. Y., has announced a new schedule of discounts, effective Aug. 22, applying to "Eveready" flashlights and flashlight batteries.

The significant part of the change is the reduction in the number of flashlights making up a unit package. Heretofore, unit packages consisted of 10 or five flashlights, and now this has been reduced to three and two flashlights on tubular types and four and three flashlights on the pocket types, while some of the higher-priced articles have been reduced so that an individual flashlight is considered a unit package. The new type of package will doubtless prove of advantage in the sale of the products.

A Non-Corrosive Concentrated Soldering Paste.

Through careful research in conjunction with extensive tests conducted under actual shop conditions, the Mitchell-Rand Manufacturing Co., 20 Vesey street, New York City, has been able to develop a formula for making the "Shield Brand" soldering paste which contains no acid and is claimed to be absolutely non-corrosive as it contains no materials that will cause sulphation if the soldering job is properly performed.

The rapid "flow" of the solder and the clean, smooth and strong union of all metals except aluminum, resulting, characterize the product as an excellent flux. The high grade machines used in its preparation insure a mixture wherein all the component parts are thoroughly blended and uniformly distributed. Due to its high concentration, it is claimed that less is required than usual for the soldering operation.

Line of Contactors for Use With D-C. Motors.

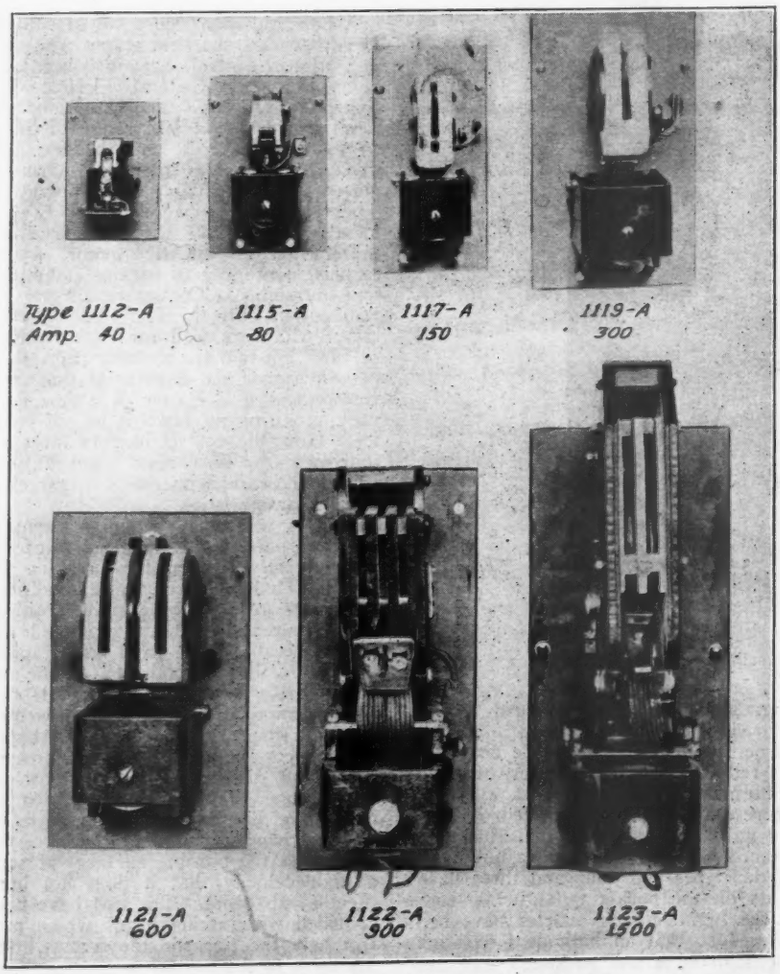
A new and improved form of contactor, known as the bent-frame type, for d-c. motor control, has just been developed by the General Electric Co., Schenectady, N. Y. The ratings of the new line include a size range of from 40 to 1500 amperes, and the line also takes in contactors for both normally closed and normally open operation. These contactors were especially designed to meet the three principal requirements of electric motor drive; namely, continuity of service, simplicity and durability. Continuity of service implies not only the fact that the contactor will work well for a long period of time, but that the wearing parts shall be so designed and constructed that their replacement is a matter of a few minutes, requiring no interruption of service. How the new contactors meet requirements is best seen from an explanation of their mechanical and electrical characteristics.

In this new line particular attention has been paid to the construction of the parts directly concerned in breaking the circuit. Under severe service conditions contactors of former designs required frequent renewal of the tips and arc chutes, because these parts were rapidly burned by the concentration of the arc at the tips. In the new contactors this concentration of the arc is prevented by, first, the use of large pear-shaped pole pieces which give an increased force and distribution to the blow-out flux, second, the arc chute has been increased in size to increase its radiation and restricted at the mouth to force the arc across the burning surfaces at such a high velocity that it does not burn them at any spot. The tips have been provided with arcing horns which protect both the tips and the screws holding them to the contactor.

By these means the life of the tips and chutes has been greatly increased,

and the rupturing capacity of the contactor as a unit has been made much greater than that of previous types. As to replacement expense, an actual life test showed that where it formerly was necessary to renew contactor tips about once a week, and the chutes about once a month, both the tips and the chutes of the new contactor were in good condition after six weeks operation.

The armature construction varies slightly with the different sizes. On the 40-ampere size it is a punched-steel plate with a right angle piece bent out at the bottom. On the 80 to 600-ampere sizes it is a bent-steel U-shaped section to which is attached the arm carrying the moving contact, and on the 900-ampere and 1500-ampere sizes the section is of cast steel. The armature fits inside the frame which is also a U-shaped piece of steel plate, the former being hung on a pin which fits in bushings. The armature and bracket pins both have a longer life in these contactors, due to the direction of the forces acting on them. This means that the contactors will operate satisfactorily for a longer period with resultant reduced maintenance cost. Another improved feature is the operating coil which slips on over the core and is held by bronze washer fitting in a slot in one end of the core. The coils are somewhat longer in proportion to their diameter, which increases the radiation factor and so increases the allowable voltage range on which the contactors will operate. As to the shunts, they are made of flexible material and are clamped directly to the contacts, a construction which reduces local heating because the number of joints through which the current has to pass is reduced to a minimum and because they make good contact. The normally closed contactors are similar to the standard normally open ones, with the addition of extra parts, and they present a similar appearance. The frame and armature are inverted, and the contacts are held closed by springs provided for the purpose.



Bent-Frame Shunt Contactors Ranging In Capacity From 40 to 1500 Amperes for Use With D-C. Motors.

Small Motor Starter with Safety Features.

A new type of motor starter, known as the type WK-30, and which provides complete protection to both the operator and the motor, has been developed by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., for starting small a-c. motors by connecting them directly to the line.

This starter consists essentially of an inclosed quick-make-and-break knife switch, which is operated by an exterior handle. It protects the motor from overloads both when starting and when running because it is equipped with thermal cutouts which open the circuit on dangerous sustained overloads but do not operate under harmless momentary overloads. The cutouts resemble cartridge fuses, but are not interchangeable with fuses, so that the latter cannot be substituted for them. They operate by fusing a special washer, which can be replaced in a few second's time at negligible cost, according to the manufacturer's statement.

All parts are inclosed so that the operator cannot touch live contacts. A door gives access to the cutouts, but this door is interlocked with the switch and cannot be opened unless the switch is in the "off" position, when all accessible current carrying parts are dead. If desired, this door can be padlocked to prevent access of unauthorized persons to the cutouts. It is also possible to lock the handle in the "off" position with three separate padlocks for the protection of those working on the machinery controlled by the switch. These starters are made in sizes for a-c. motors up to 3 hp., 110 volts; 10 hp., 250 volts; and 10 hp., 600 volts.

Compact and Rugged Motor Starter.

Tool for Bending "Wiremold" to Any Desired Shape.

"Introducing the New Wiremold Bender" is the title of a folder issued by the American Wiremold Co., Hartford, Conn., to describe a new tool which the company recently developed. The accompanying illustration shows how bends or offsets may be made in the middle of a length of "Wiremold" by the use of the tool.

New "Wiremold" Bender.

It is stated that the tool will bend "Wiremold" to any desired shape with ease and perfection, and makes the most difficult surface wiring job easy to install.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Olive Branch Lighting Co., Noblesville, Ind., has filed notice of dissolution under state laws.

Hoyt Electric Co., New York City, has leased property at 688 Lexington avenue, near 56th street, for a new local establishment.

Welsbach Gas Lamp Co., 392 Canal street, New York City, sustained a loss of about $25,000 recently, a portion of its works being destroyed by fire.

Standard Underground Cable Co., Westinghouse building, Pittsburgh, is completing plans for the erection of a 1-story plant on 16th street, estimated to cost $12,000.

Daniel M. Luehrs Co., 2015 East 65th street, Cleveland, industrial engineer, has issued circulars illustrating the "Luehrs" electric oil roasting and heating systems.

Cooper Hewitt Electric Co., Ninth, Adams and Grand streets, Hoboken, N. J., sustained a loss of about $75,000 by fire recently, one of the buildings at the plant being destroyed.

Schweitzer & Conrad, Inc., 4435 Ravenswood avenue, Chicago, has issued bulletin No. 106-A covering simplified protective combinations for rural and small town service.

McPhilben Lighting Fixture Co., 264 Fulton street, Jamaica, L. I., N. Y., has arranged for an increase in its capital stock for extensions in manufacturing and general operations.

National Metal Molding Co., Pittsburgh, has recently issued a folder covering the new "Flextube" carton —the new way of packing the company's flexible nonmetallic conduit.

Dayton-Dowd Co., Quincy, Ill., manufacturer of centrifugal pumps, has issued bulletin No. 246, illustrating and describing its line of "Approved Underwriters' Centrifugal Fire Pumps."

J. H. Schmidt, Muskogee, Okla., has awarded a contract to Dickman & Nelson for the erection of a 1-story plant for the manufacture of electric batteries and other electrical equipment, estimated to cost $50,000, including equipment.

John A. Roebling's Sons Co., South Broad street, Trenton, N. J., manufacturer of wire, cables, etc., has preliminary plans under way for the construction of a 1- and 2-story copper wire manufacturing building, 500 by 850 ft., estimated to cost $150,000.

Steel City Electric Co., 1207 Columbus avenue, Pittsburgh, manufacturer of electrical specialties, has issued a new edition of its catalog No. 33. A new 3-story addition to the company's factory is shown in the foreground of the view on page 1, in connection with a photograph of the Pittsburgh factory and main office. Pages 12 and 21 illustrate the new line of "Wirelets" conduit bodies and covers; page 76 shows the Fullman floor outlets, and page 100 depicts squeeze connectors and Adapter collar and locknut for attaching standard or angle connectors to "Wirelets," or to other boxes with 0.75-in. knockouts. The new octagon concrete outlet boxes are described on pages 37, 37A and 37B. The company calls attention to the elimination of certain outlet boxes and covers on pages 22 to 39, in accordance with the recommendations of the Standardization Committee of the Associated Manufacturers of Electrical Supplies.

Allis-Chalmers Manufacturing Co., Milwaukee, has prepared a revision of its bulletin on type E d-c. motors and generators. Type E motors are manufactured for either constant or adjustable speed conditions and for standard voltage of 115, 230 and 550. The new bulletin is known as No. 1106-A.

Radio Corporation of America, Woolworth building, New York City, has acquired the plants and business of the International Radio & Telegraph Co., operating stations at Cape May, N. J.; New London, Conn.; Nantucket Island, Belfast, Me.; Newport, R. I.; and at the Bush Terminal, New York City.

Ajax Electric Specialty Co., 1011 Market street, St. Louis, has announced that I. A. Bennett Co., 112 West Adams street, Chicago, is its exclusive district sales representative for the following territory: States of Indiana, Illinois, Wisconsin, upper peninsula of Michigan, states of Minnesota and North and South Dakota.

W. N. Matthews & Brother, Inc., St. Louis, has announced that Martin J. Wolf, second vice-president and director of the company, has asked for and been granted an indefinite leave of absence. Mr. Wolf has been with the Matthews concern for a little over 7 yrs. He will retain his directorship, stock ownership and title and will remain in St. Louis.

Triumph Electric Co., Cincinnati, for nearly 30 yrs. manufacturer of "40° Triumph" polyphase induction and d-c. motors, has again been forced to move its Philadelphia office to larger and more spacious quarters to adequately take care of the increasing demand for its product in that section. The new quarters are at 709 Arch street. This territory is under the direction of Arthur H. Allen, district manager.

Robbins & Myers Co., Springfield, O., manufacturer of electric motors, generators and fans, has announced that with the resignation of Eugene Newnham as sales manager of the motor department, the following changes in the sales organization, effective Sept. 1, have occurred: W. W. Mumma, formerly sales manager of the fan department, becomes general sales manager with jurisdiction over both fan and motor sales; A. J. Reed of the motor sales department, who was for several years manager of the Cleveland branch, becomes assistant sales manager, motor department; F. W. Burmeister of the fan sales department, becomes assistant sales manager of the fan department.

Batterman-Truitt Co. has announced that at a recent meeting of stockholders the firm name was changed to the **Autovent Fan & Blower Co.,** the company's address remaining the same, 730-738 West Monroe street, Chicago. There has been no change in the personnel or management of the company, it is stated, as the same officers, board of directors and stockholders remain with the company. This change in corporate name only has been decided upon by the management, believing that a corporate name which is indicative of the products as manufactured by the company will be more beneficial to its customers as well as the firm. The manufacture, sales and distribution of its line of "Autovent" fans, louvres and "Uniblade" blowers will be carried on under the same guiding hands and supervision as heretofore.

Penn Electric Machine Co., 114 Eighth street, Des Moines, Ia., has issued bulletins Nos. 11 and 22, the first illustrating and describing its type "R" pressure switch and the latter the type "HP" pressure switch. It is stated that type "R" is an automatic pressure regulator for use on electric house pumps and other pressure equipment within its capacity, and is designed for motors up to 1 hp. and for pressures up to 50 lbs. The type "HP" is a simple compact switch, entirely inclosed and easily mounted and adjusted; having no triggers or locks or other delicate mechanism; incorporating an improved contact construction which insures perfect seating at all contact points and a highly developed trip mechanism for quick make and break. It is designed for motors up to 5 hp., and for pressures up to 200 lbs.

Gold Car Heating & Lighting Co., Bush Terminal, 220 36th street, Brooklyn, N. Y., has issued an illustrated 32-page catalog on electrically operated temperature regulating systems. It fully describes its electric method of automatic control of steam, hot water or hot air heating apparatus in residences, offices and public buildings, as well as for maintaining a predetermined temperature in tanks, vats, dry rooms, etc. Specifications and diagrams for each system are also given. The novel feature of this apparatus is that each control is "A Unit by Itself" operated entirely by electricity and is easily installed. It will work successfully on any of the commercial voltages from 32 volts up and requires no batteries or installation of air compressors.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

JAMES CARNEGIE, JR., has been appointed engineer of power plants for the Kwang Tung Electric Supply Co., Ltd., Canton, China.

JOHN T. MCDONALD, expert accountant at the Pittsfield (Mass.) works of the General Electric Co., has been elected tax collector of that city.

J. F. HUMEZ, former domestic sales manager of the Macbeth-Evans Glass Co., 19 West 44th street, New York City, is now located in Detroit for the same company.

A. G. SHERMAN, of the Detroit Vapor Stove Co., was elected president of the Detroit Chapter of the Society of Industrial Engineers at a recent meeting of that organization.

C. B. COLE has opened a consulting engineer's office at 546 Washington boulevard, Chicago, and will specialize on tools, gages, interchangeable manufacture and inspection systems.

DR. VIRGIL C. KINNEY, Wellsville, N. Y., was elected president of the American Electrotherapeutic Association at the recent convention of that organization held in Washington, D. C.

H. L. LISSFELD, for the past year export manager of Macbeth-Evans Glass Co., 19 West 44th street, New York City, has recently been appointed in addition manager of the New York territory.

IRA S. WEISS has been elected secretary and treasurer of the Keystone Telephone Co., Philadelphia, succeeding Elwood F. Reeves, deceased. Mr. Weiss previously has been acting as assistant secretary and treasurer of the company.

W. J. COCHRANE, who has been doing maintenance and electrical construction work with the Canadian General Electric Co., Ltd., Toronto, Ont., has entered the consulting engineering field, and is now a partner in the firm of Fitzgerald & Cochrane, Hamilton, Ont.

G. H. WIRTH, who was formerly superintendent of construction with the Bainbridge Electric Co., Philadelphia, has entered the employ of the Federal Board of Vocational Rehabilitation as instructor in engineering subjects, with headquarters at U. S. P. H. Hospital 49, Philadelphia.

PROF. E. DANA DURAND, of Minnesota University, has been appointed chief of the Eastern European Division of the Bureau of Foreign and Domestic Commerce. He is a former director of the Census Bureau and a former professor at Harvard University.

ROSS C. PURDY, formerly director of research of the Norton Co., Worcester, Mass., and for the past 2 yrs. consulting ceramist in Buffalo, N. Y., and elsewhere, has been appointed permanent general secretary of the American Ceramic Society, of which he was president in 1909 and 1910.

MARTIN J. WOLF, until recently vice-president and sales manager of W. N. Matthews & Bro., Inc., of St. Louis, has been appointed sales manager of the Bussmann Manufacturing Co., manufacturer of "Buss" fuses. Few men are better or more favorably known in the electrical industry. "Martin," as he is affectionately and familiarly called, broke into the electrical field in 1910 with the Hobson Electric Co. of Dallas, Tex., as assistant sales manager. He soon became a prominent figure in electrical circles in the Southwest, attracting attention by a striking personality and his vigorous campaigning in the development of unusual business ideas. Early in 1913 he went to Chicago as sales manager of the Hot Point Electric Heating Co., the headquarters of which were at Ontario, Cal. His aggressive methods in connection with this organization in some measure worked a remarkable change in the merchandising of electrical appliances. In 1914 Mr. Wolf joined the organization of W. N. Matthews & Bro. as manager of sales, becoming vice-president and a director in 1916. In this company he retains his identity as an officer and stockholder. He has always been an exponent of vigorous but strictly ethical sales policies; has taken the lead in preaching and practicing co-operation between the various elements of the electrical industry, and he was for many years prominently identified with the Jovian Order as Statesman during several administrations and Jupiter, or reigning head, in 1916. He is a close student of business administration, business economics and the psychology of salesmanship and has lectured upon the last named subject before business, fraternal and civic organizations in many parts of the country. His wide knowledge of business conditions, his intimate acquaintance with manufacturing and merchandising of electrical supplies as they are related to every element in the industry, and his virile and acceptable personality will find a splendid opportunity for expression in the rapidly growing and aggressive organization with which he is now connected.

Martin J. Wolf.

W. A. CLAY, formerly with the Robins Conveying Belt Corp., New York City, is now connected with the Callaghan Publicity Film Service, Inc., 220 West 42d street, New York City, specialist in motion-picture advertising and sales service.

DR. VICTOR M. BERTHOLD, chief foreign statistician, American Telephone & Telegraph Co., 195 Broadway, New York City, is writing a history of the telephone and telegraph services in all Latin-American countries and the first of the series, that for the Argentine Republic, has been completed. The booklet gives a full account of the origin and development of the services in this country and the laws governing concessions and concludes with a summary of the telegraph statistics.

OBITUARY.

H. B. BUSH, Bedford, O., president of the Bush Electric Co., Cleveland, and inventor of safety devices for use in working on high-voltage lines and equipment, met with a fatal accident last week, during a demonstration being given in Worcester, Mass. The exact cause of the accident has not as yet been determined, according to the information available, but it is reported that some piece of equipment failed during a 66,000-volt test and that the gases given off as a result of this failure were the direct cause of the death of Mr. Bush. He was engaged in electrical work all his life, having been connected with the Southern California Edison Co. for a number of years. He is well known in the West for his development of safety methods and tools, and was becoming well known the country over at the time of his death. At the same time, and as a result of the same accident, Percy C. Henry, was killed, and Joseph B. Armstrong was seriously injured, both of Worcester, Mass. Mr. Bush is survived by his wife and five children.

PERCY C. HENRY, Worcester, Mass., superintendent of distribution for the New England Power Co., was instantly killed last week in an accident met with during a demonstration of testing equipment. The exact cause of the accident has not as yet been determined, according to the information at hand, but it is reported that some piece of equipment failed during a 66,000-volt test and that the gases given off as a result of this test were the direct cause of the death of Mr. Henry. At the same time, and as a result of the same accident, H. B. Bush, Bedford, O., was killed. Mr. Henry resided at 35 Harvard street, Worcester, Mass. He had many friends in the electrical industry and was a member of the American Institute of Electrical Engineers.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES.

West Pownal, Me.—The State Commission for the Feeble Minded, Augusta, Me., has awarded a contract to the H. P. Cummings Contracting Co., Fidelity building, Portland, Me., for the erection of a 1-story power house, 45 by 75 ft., at the State School, West Pownal, estimated to cost $75,000.

Concord, N. H.—Electric motors and other electrical equipment will be installed in the 4-story printing plant, 80 by 180 ft., to be erected on Ferry street, by the Rumford Press, estimated to cost $175,000.

Shirley, Mass. — Electrical and steam-operated equipment will be installed in the 1- and 2-story mechanical laundry and kitchen, 35 by 140 ft., to be erected by the board of directors, State Industrial School, estimated to cost $65,000.

Taunton, Mass.—Electrical and mechanical equipment will be installed in the story addition to be erected at the tile mill of the Whitenton Manufacturing Co. Charles T. Main, 201 Devonshire street, Boston, is architect.

Westfield, Mass.—Westfield Power Co. is planning the rebuilding of the portion of its plant destroyed by fire Aug. 27, with loss estimated at $25,000.

Worcester, Mass.—R. H. Long Co. will break ground at once for the erection of a 1-story power house, 41 by 72 ft., at its new local automobile manufacturing plant on Millbrook street. Considerable electrical equipment will be installed in different departments of the works, which are estimated to cost $500,000.

Hartford, Conn.—Considerable electrical equipment will be installed in the 4-story plant addition to be erected by the United States Envelope Co., 248 Pearl street, estimated to cost $50,000.

Albany, N. Y.—Considerable electrical equipment will be installed in the 4-story factory to be erected by the Gibson-Snow Drug Co., Broadway and Orange street, estimated to cost $150,000.

Albany, N. Y.—A. L. Cadle, superintendent of Public Works, Capitol building, will receive bids until Sept. 28 for the installation of a new electric crane on the barge canal terminal, Mott avenue, New York City.

Buffalo, N. Y.—Electric motors and other electrical equipment will be installed in the 3-story plant, to be erected by the Duffy Silk Co., 1260 Broadway, estimated to cost $50,000.

Buffalo, N. Y.—Electrical equipment, refrigerating apparatus, etc., will be installed in the 4-story cold storage and cooler building to be erected by the Danahy Packing Co., 25 Metcalfe street, estimated to cost $50,000. H. Brown, 28 Glenwood avenue, is architect.

Cadyville, N. Y.—International Paper Co., 30 Broad street, New York City, has commenced the erection of its proposed hydroelectric power plant on the Saranac river, near Cadyville, estimated to cost $250,000.

New York, N. Y.—The Board of Directors, Mt. Sinai Hospital, 110th street and Ffth avenue, has filed plans for extensions and improvements in the power house at the institution.

New York, N. Y.—Considerable electrical equipment will be installed in the 8-story factory and warehouse building to be erected by R. H. Macy & Co., 34th street and Broadway, at 418-26 Eleventh avenue, estimated to cost $300,000.

North Tonawanda, N. Y.—Considerable electrical and mechanical equipment will be installed in the new filtration plant proposed by the City Council. The local chamber of commerce has organized a filtration committee to perfect details of the project.

Ogdensburg, N. Y. — Ogdensburg Power & Lighting Co. has filed notice of increase in its capital stock from $50,000 to $150,000.

Potsdam, N. Y.—Hannawa Falls Water Power Co. has filed notice of increase in its capital stock from $300,000 to $1,000,000.

Potsdam, N. Y.—Massena Electric Light & Power Co. has filed notice of increase in its capital stock from $50,000 to $150,000.

Potsdam, N. Y.—Potsdam Electric Light & Power Co. has filed notice of increase in its capital stock from $22,000 to $75,000.

Syracuse, N. Y.—Electrical and machanical equipment will be installed in the new pottery addition to be erected on Court street by the Inondaga Pottery Co., 1858 West Fayette street, manufacturer of chinaware, etc., estimated to cost $50,000.

Camden, N. J.—The City Council is planning the installation of additional street lamps on Market and Federal streets.

Camden, N. J.—Considerable electrical equipment will be installed in the mechanical laundry building to be erected by the board of directors of the Cooper Hospital, for service at the institution.

Elizabeth, N. J.—The Board of Education has perfected plans for the erection of a powerhouse addition, in connection with an extension to the Battin High School.

Jersey City, N. J.—Electric hoisting, freight loading and unloading equipment, etc., will be installed on the pier to be constructed at the foot of 12th street by the Erie Railroad Co., estimated to cost $1,000,000. R. C. Falconer, 50 Church street, New York City, is company engineer.

Newton, N. J.—Newton Electric & Gas Co. has received permission from the Board of Public Utility Commissioners to issue common stock for $53,000, to be used for general operations, extensions, improvements, etc.

Ocean City, N. J.—The Board of Freeholders, Cape May, will make extensions and improvements in its electric plant at Ocean City. M. D. Rice, Wildwood, is county engineer.

Vineland, N. J.—Electrical equipment, refrigerating apparatus, etc., will be installed in the local cold storage plant to be erected by the State Poultry Producers' Association.

Carlisle, Pa.—The Street Lighting Committee of the Chamber of Commerce has plans under way for the installation of additional street lamps on Hanover and High streets and other thoroughfares in the busiess district.

Economy, Pa.—Considerable electrical equipment will be installed in the addition to be erected at the plant of the Wyckoff Drawn Steel Co., Frick building, Pittsburgh, located near Economy, estimated to cost $60,000.

Harrisburg, Pa.—Harrisburg Light & Power Co. will construct a pole line for service at the electrically operated pumping station in the west side district, including new feed wires.

Hazleton, Pa.—The plant of the Hazleton Steam Heating Co., a defunct organization, is being dismantled.

Juniata, Pa.—Juniata Public Service Co. is arranging for the installation of lighting systems in a number of towns in this section, and has made application to the Public Service Commission for permission to enter into contracts with the different boroughs for the service.

Kittaning, Pa.—Electrical and mechanical equipment will be installed in the filter plant to be constructed by the Armstrong Water Co.

Philadelphia, Pa.—The Board of Works will install considerable electrical machinery in the pumping station for the waterworks system to be constructed at Torresdale.

Philadelphia, Pa.—Franklin Sugar Refining Co., Reed street, will make extensions and improvements in its powerhouse to cost about $20,000.

Philadelphia, Pa.—Electric motors and other electrical equipment will be installed in the addition to be erected by the Keystone State Laundry Co., 1108-12 West Dauphin street.

Philadelphia, Pa. — Considerable electrical equipment will be installed in the 3-story plant to be erected on

Thomas street by the Mayer Baking Co., 60th street and Hazel avenue, estimated to cost $150,000.

Pittsburgh, Pa.—Standard Sanitary Manufacturing Co., Preble avenue, has construction under way on a 1-story powerhouse at its plant, estimated to cost $25,000.

Pittsburgh, Pa.—Considerable electrical, mechanical and refrigerating equipment will be installed in the 2-story plant to be erected by the Union Ice Co. on Beaver avenue, for ice manufacturing and refrigerating service, estimated to cost $100,000. C. G. Gerber, Park building, is architect.

Pittsburgh, Pa.—Architect John L. Windrim, Philadelphia, is preparing plans for a 20-story building to be erected by the Bell Telephone Co. The estimated cost is $1,900,000.

Pittsburgh, Pa.—Fire Aug. 30 destroyed a portion of the generating department at the substation of the Duquesne Light Co., Forest and Maryland avenues, Bellevue, with loss estimated at $20,000. The structure will be rebuilt.

Baltimore, Md.—The Board of Awards will install a new electric lighting system at the North Western Police Station, with signal and other equipment.

Baltimore, Md.—In connection with its recent bond issue, the Consolidated Gas, Electric Light & Power Co., Lexington building, has arranged for an increase in its capital stock from $30,000,000 to $55,000,000.

Baltimore, Md.—Electrical and mechanical equipment, with refrigerating machinery to cost about $200,000, will be installed at the new plant of the Western Maryland Dairy Co., Linden and Dolphin streets. A. B. Gardner is president.

Baltimore, Md.—The Department of Lamps and Lighting, John J. Hanson, superintendent, is considering an application submitted for the installation of a new "white way" street-lighting system on Park avenue, between Saratoga and Franklin streets.

Baltimore, Md.—A powerhouse will be erected by the board of directors of the University of Maryland in connection with the erection of its proposed buildings at Greene and Lombard streets, estimated to cost $1,250,000.

Lynchburg, Va.—Plans are being perfected for the construction of a municipal electric light and power plant. Lamar Lyndon, 21 Park Row, New York City, is consulting engineer. E. A. Beck is city manager.

South Hill, Va.—The Common Council has arranged for a bond issue of $150,000, the proceeds to be used for extensions and improvements in the municipal electric system and other borough work.

Buckhannon, W. Va.—Buckhannon Light & Water Co. has commenced the erection of the superstructure for its proposed 1-story powerhouse.

Cedar Grove, W. Va.—Hackett Coal Co. will install new electrical and other equipment at its local properties.

Chelyan, W. Va.—Chelyan Electric, Water & Ice Co. has plans under way for the establishment of a new electric plant with transmission and distributing system in this section. B. M. Green, Charleston, W. Va., is engineer. Ernest E. Coon is secretary and treasurer.

Asheville, N. C.—Asheville Power & Light Co. will make extensions and improvements in its plant. Plans are being completed for the work. Address H. W. Plummer, manager.

Walnut Cove, N. C.—The City Commission is perfecting plans for the rebuilding of its municipal electric plant, recently destroyed by fire. M. T. Chilton, city commissioner, is in charge.

Columbia, S. C.—Columbia Railway & Navigation Co. has been granted a preliminary permit by the Federal Power Commission for its proposed hydroelectric power plant.

Atlanta, Ga.—Southern Bell Telephone Co. will place wires underground, and make other extensive improvements. Address Mr. McGee, in charge of construction.

Bartow, Ga.—The Borough Council is arranging a bond issue for the construction of a transmission line for electric light and power service in the municipality. A local substation will be constructed.

Brunswick, Ga.—Electric motors and other electrical equipment will be installed in the plant to be erected by the Industrial Chemical & Fertilizer Co., recently organized. Plans are being prepared. B. S. Brown is general manager.

Greensboro, Ga.—Considerable electrical equipment, refrigerating apparatus, etc., will be installed in the plant to be erected by the Greensboro Cooperative Creamery. R. L. Caldwell heads the company.

NORTH CENTRAL STATES.

Galion, O.—A new electric light plant for the city was recommended by the James H. Herron Co., engineer, whose report was read before the council recently. The estimated cost will be $132,020.

New Philadelphia, O.—Bonds to the amount of $12,000 have been voted to electrify the waterworks department. Address the city clerk.

Grand Rapids, Mich.—The Marquette Lumber Co., 1555 Taylor street, has completed plans for the erection of a 2-story powerhouse at its plant.

Reed City, Mich.—Arthur Mulholand, superintendent of the Reed City Light & Power Co., recommends an automatic gate lifter or spillway.

Bloomington, Ind.—The Board of Trustees, Indiana University, has awarded a contract to Hayes Brothers, 236 West Vermont street, Indianapolis, for extensions and improvements in the power plant at the institution to cost about $40,000.

Indianapolis, Ind.—The Board of County Commissioners is taking bids up to Sept. 27 for extensions and improvements in the powerhouse at the County Jail, including considerable remodeling work.

Kendallville, Ind.—The Board of School Trustees will make additions and improvements in the powerhouse used for local schools.

Kendallville, Ind.—The Board of Works, S. E. Dickinson, general superintendent, has awarded a contract to A. Bentley & Sons, 201 Belmont avenue, Toledo, O., for the erection of a 1-story addition to the municipal power plant, 50 by 102 ft.

Kokomo, Ind.—Arc lamps were asked by petitioners of North McCann street between the 1700 and 1800 numbers, and at the corner of Lafontaine and Jackson streets. The board took the request under advisement.

Mt. Morris, Ill.—Mrs. B. L. Brayton, of the committee of the Women's Club, having the lamp question in charge, states that the proposed boulevard lighting system will be installed.

Grand Rapids, Wis.—The Wisconsin-Minnesota Light & Power Co. has received permission from the Federal Power Commission, Washington, D. C., to construct a hydroelectric power station on the Chippewa river, Sawyer county.

Minneapolis, Minn.—The Northern States Power Co. has made application to the Federal Power Commission, Washington, D. C., for permission to build a hydroelectric generating plant at U. S. Dam No. 1 on the Mississippi river, near St. Paul, Minn.

Minneapolis, Minn.—City of Minneapolis has applied to the Federal Power Commission for a preliminary permit to develop power at the United States Lock and Dam No. 1, at St. Paul in the Mississippi river. This application conflicts with that of the City of St. Paul and of the Northern States Power Co. The proposed use is for municipal purposes.

Dubuque, Ia.—Plans for a building to house the fire alarm system have been prepared at an estimated cost of $6000. Address Manager Carr.

Laurel, Ia.—The Haverhill-Laurel Electric Co. has been incorporated with a capital of $50,000. Peter Neuroth is president. The purpose of the company is to furnish light and power to Haverhill and Laurel and the surrounding communities. The company will sell electrical machinery, fixtures and appliances.

Kansas City, Mo.—Kansas City Power & Light Co. is planning the early operation of a 1-story substation at 61st and Forest streets, now nearing completion.

Kansas City, Mo. — Considerable electrical equipment will be installed in the proposed new plant of the Unico Motor Products Co., 1229 West 59th street, on Rochester avenue, estimated to cost $50,000. W. R. Alexander is head.

St. Charles, Mo.—Engineers Benham & Mullgren, 8th floor Firestone building, Kansas City, are preparing plans for a $200,000 electric light plant and distributing system to be erected by the city of St. Charles. Address Otto Boekemier, city clerk.

St. Louis, Mo.—The Excelsior Laundry Co., Grand and Bell streets, will break ground at once for the erection of a 2-story power plant and mechanical laundry works at Texas and

Victor streets, estimated to cost $200,000 with machinery. B. T. Kearns is president.

Iroquois, S. D.—The people are temporarily without electric lights and power as the result of a fire which destroyed the building occupied by the electric light plant and badly damaged the machinery. Insurance to the amount of $1200 was on the building and $6000 on the equipment.

SOUTH CENTRAL STATES.

Covington, Ky.—Architects Harry Hake & Charles Kuck, Telephone building, Cincinnati, are preparing plans for a $600,000 telephone exchange building to be erected by the Citizens Telephone Co. of Kentucky. Address B. L. Kilgour.

Lexington, Ky.—Lexington Utilities Co. has awarded a building contract for the erection of an addition to its plant to cost about $12,000, exclusive of equipment.

Knoxville, Tenn.—S. K. Ruckman Electric Co., 217½ South Gay street, has been organized to operate a local electric system. S. K. Ruckman heads the company.

Gulfport, Miss.—Considerable electrical equipment will be installed in the proposed oil refinery to be erected here, with initial daily capacity of about 300 bbls. A company is being organized by Charles T. Madison and George S. Dodds to construct and operate the plant.

Jackson, Miss.—The State Board of Improvement will purchase 16 lighting plants for the state prison farms.

Crowley, La.—The Common Council is completing plans for the erection of a municipal electric power plant, to be operated in conjunction with a waterworks system.

Monroe, La.—About $60,000 will be expended by the Cumberland Telephone & Telegraph Co., which includes 8 or 9 mi. of cable, additional switchboard facilities, etc. Address O. H. Bynum, manager.

New Orleans, La.—A plant costing $1,000,000 will be erected by W. E. Wren to generate electricity.

New Orleans, La.—Harry K. Johnson, 1003 Hibernia building, and associates have made application to the City Council for a franchise for the establishment of a new electric light and power plant for service in outlying districts.

Crescent, Okla. — The Common Council is planning extensions and improvements in the municipal electric plant. Address A. B. Powell, clerk.

Duncan, Okla.—Duncan, Ardmore & Lawton Interurban Co. has been chartered to build an electric railway 115 mi. long from Ardmore to Lawton, via Duncan. The incorporators are B. M. Pillotson, J. J. Marshall, Allen A. Harris, and others. The estimated cost is $5,000,000.

Fairfax, Okla.—Bonds to the amount of $80,000 have been voted by the city to improve the lighting system, pump station, etc., and to extend the water and sewer systems into the Tall Chief addition, and to install fire equipment. Address the mayor.

Ketchum, Okla. — Byron Kirkpatrick, Tulsa, Okla., and W. B. Collins, Ketchum, are organizing a new company, capitalized at $2,000,000, to construct and operate a hydroelectric generating plant on the Grand river, with distributing system to reach all communities in this section.

Manchester, Okla.—W. B. Rollins & Co., 209 Kentucky Exchange building, Kansas City, Mo., engineer, has submitted plans for the construction of a transmission line from Manchester to Anthony, Kans. Address Owner City, care Wm. Blecha, city clerk. Bonds will be voted Sept. 23.

Pryor, Okla.—The Common Council is considering plans for the construction of a transmission line from the municipal power plant on the Grand river to the pumping station used for the local waterworks. Address Mayor Harrison.

Woodward, Okla.—Engineers Black & Veatch, 7th floor Mutual building, Kansas City, Mo., have prepared plans for electric light improvements for the city. Address the city clerk.

New Braunfels, Tex.—Planters and Merchants Mills will install a 440-hp. hydroelectric plant on the Gaudalupe river to generate electricity for operating a gingham mill to be erected at New Braunfels. The mill equipment and dam will cost about $764,000. Address S. M. Ransopher, president, 200 East 40th street, Austin, Tex.

Whitney, Tex.—Electric light bonds to the amount of $15,000 have been voted. Address the mayor.

WESTERN STATES.

Boise, Ida.—Application has been filed by Rupert Winters Featherville for a permit to construct a dam on the Boise river in Camas county. The estimated cost will be $75,000. The dam is to be used for electric power for mining purposes.

Redlands, Cal.—Southern Sierras Power Co. is planning the establishment of a $500,000 power plant in Mill Creek canyon, near Forest Home, as per announcement made by the company officials. No date has been announced for a hearing before the State Water Commission.

Havana, Cuba.—The Havana Electric Railway, Light & Power Co. has arranged for a note issue of $1,500,000, the proceeds to be used for extensions, improvements, general operations, etc.

Ottawa, Ont.—The Board of Public Works will take bids at an early date for the construction of a hydroelectric generating plant in the Fort Matachawan district, with initial capacity of about 10,000 hp. The plant, with necessary site development, will cost about $500,000.

INCORPORATIONS.

Brooklyn, N. Y.—Gas-Electric Appliance Co. Capital $20,000. To manufacture electrical and gas equipment and appliances. Incorporators: E. J. and T. E. Byrne, and L. P. Doyle. The company is represented by Cullen & Dykman, 177 Montague street.

Asbury Park, N. J.—Radio Service Laboratories, Inc. Capital $50,000. To manufacture wireless equipment and electrical apparatus. Incorporators: Harold M. Lewis, Hobart H. Simpson and Joseph M. Turner, 701 Mattison avenue.

Hoboken, N. J.—Hoboken Lighting Fixture & Supply Co., 614 Washington street, has filed notice of organization to manufacture electric lighting fixtures and kindred equipment. The company is headed by Benjamin Johns.

Woodbridge, N. J.—Woodbridge Electric Co., 99 James street, has filed notice of organization to deal in electrical products. The company is headed by Francis B. Acker.

Jersey City, N. J.—Elkin & Hanbury, 161 St. Paul's avenue, have filed notice of organization to operate an electrical contracting business. The company is headed by Meyer Elkin and Hugh Hanbury.

Norristown, Pa.—The Franklin Air Compressor Works. Capital $50,000. To manufacture air compressors and kindred equipment. George C. Yates, 27 West Pomona street, Philadelphia, is treasurer.

Philadelphia, Pa.—Seville Electric Co. is being organized by John A. Seville and Frank B. Haag to operate an electrical contracting business. Application for state charter will be made on Sept. 20. The company is represented by Francis G. Gallagher, Lincoln building.

West New York, N. J.—Easton Electric Co., 444 Bergenline avenue. Filed notice of organization to deal in electrical products. Michael Cohen heads the company.

Trenton, N. J.—Electric Amusement Co. Capital, $125,000. To manufacture electrically-operated amusement devices. Incorporators: Lehman H. Garrison and William C. Matlack, Trenton; Henry S. Wilson, Jr., Philadelphia, Pa.

Sykesville, Md.—Preedom District Electric Light Co. Capital, $5000. To operate an electric light and power system in Carroll county. Incorporators: George H. Bavard, John T. Scott and Charles C. Williams.

Pittsburgh, Pa.—King Radio Co. Capital, $10,000. To manufacture radio apparatus. Incorporators: E. W. T. King and G. H. Sharman, Pittsburgh, and M. W. Palmer, Wilkinsburg, Pa.

FOREIGN TRADE.

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Supplies (35,401) — A mercantile firm in Mesopotamia desires to purchase electrical fittings such as fans, meters, bulbs, wire and telephone apparatus. Quotations should be given c. i. f. Basrah. Terms, 20% with order and balance on receipt of documents. Reference.

Electrical Supplies (35,403—A commercial agent in Italy desires to secure an exclusive agency for the sale in Sicily of electrical supplies and materials of all kinds, including motors. Quotations should be given c. i. f. Palermo. Reference.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

New Issue of Standard Gas & Electric Co. Gold Bonds.

The Standard Gas & Electric Co. has sold to a syndicate of investment bankers composed of H. M. Byllesby & Co., Federal Securities Corp., Chicago, and Hambleton & Co., Baltimore and New York City, an issue of $3,500,000 20-yr. 7.5% secured sinking fund gold bonds. Public offering was first made of these bonds Sept. 7 at a price of 94 and interest, to yield over 8.10%. The proceeds of the issue will be used toward refunding the company's 7% convertible sinking fund notes due Nov. 15.

It is stated that the Standard Gas & Electric Co., and its subsidiary companies constitutes one of the largest public utility and management organizations in the United States. The utilities are mainly electric and gas properties serving a population of approximately 2,135,000 in 533 communities including Minneapols, St. Paul, Louisville, Tacoma, Mobile, Oklahoma City, San Diego, Stockton, Cal., and other important cities.

The annual net revenue from collateral to be deposited is $1,402,000, or over five times the annual interest charges on these $3,500,000 secured 7.5% sinking fund gold bonds. The net revenue of the company is in excess of 2.6 times the annual interest charges on the total funded debt of the company, including this issue. Approximately 98% of the earnings of the company are derived from the company's holdings of public utility securities.

Southern California Edison Co.

Month of July—	1921.	1920.
Gross earnings	$1,529,825.97	$1,524,458.28
Expenses and taxes	549,173.22	606,122.45
Net earnings	980,652.75	918,335.83
Fixed charges	310,497.56	272,216.05
Balance	670,155.19	646,119.78
12 mo. ending July 31, 1921—		
Gross earnings	16,214,456.15	12,305,371.73
Expenses and taxes	6,734,298.97	5,499,124.85
Net earnings	9,480,157.18	6,806,246.88
Fixed charges	3,469,538.46	3,055,846.27
Balance	6,010,618.72	3,750,400.61

Puget Sound Power & Light Co.

	1921.	1920.
July gross	$ 770,913	$ 766,693
Net earnings	291,690	301,100
Surplus after charges	145,220	143,341
12 mo. gross	10,207,414	9,564,896
Net earnings	4,251,051	3,933,099
Surplus after charges	2,393,048	2,096,971

Galveston-Houston Electric Co.

	1921.	1920.
July gross	$ 326,634	$ 337,937
Net earnings	97,038	112,709
Surplus after charges	61,751	77,408
12 mo. gross	3,916,555	3,438,246
Net earnings	1,108,937	928,842
Surplus after charges	684,641	506,897

Blackstone Valley Gas & Electric Co.

	1921.	1920.
July gross	$ 276,845	$ 259,808
Net earnings	82,717	53,894
Surplus after charges	54,874	28,734
12 mo. gross	3,405,021	3,069,772
Net earnings	965,139	921,410
Surplus after charges	635,590	622,231

Northern Texas Electric Co.

	1921.	1920.
July gross	$ 285,998	$ 334,754
Net earnings	100,967	125,498
Surplus after charges	75,629	100,565
12 mo. gross	3,843,525	3,797,281
Net earnings	1,325,322	1,475,594
Surplus after charges	1,021,915	1,177,343

Great Western Power System.

	1921.	1920.
July gross	$ 575,551	$ 592,087
Net after taxes	371,509	350,006
Surplus after charges	126,020	152,014
7 mo. gross	4,208,965	3,373,226
Net after taxes	2,709,028	1,837,734
Surplus after charges	1,043,910	448,286

Offering of Lexington Utilities Co. Gold Bonds.

R. E. Wilsey & Co., Chicago, is offering a new issue of $560,000 Lexington Utilities Co. first lien and refunding 6% gold bonds, series "B," due April 1, 1936, at a price of 82.5 and accrued interest, to yield 8.05%. The proceeds of these oonds will be used to acquire underlying bonds, for extensions and improvements to the property, and for other corporate purposes.

The Lexington Utilities Co. owns a modern steam power plant, the electric and gas distributing systems, ice manufacturing plant and ice storage warehouse in Lexington, Ky. The company does the entire electric light and power business in Lexington, supplies power to urban and interurban railways, and under wholesale contracts furnishes power to practically all other public utility companies operating in central Kentucky. It manufactures and distributes the entire ice requirements of the city of Lexington and the adjoining territory. The territory served has a population of about 225,000. Net earnings for the year ended July 31, 1921, were in excess of 2.5 times the annual interest requirements on all its outstanding bonds, including this issue.

Southwestern Power & Light Co.

July—		Increase.
Gross earnings	$ 760,870	$ 20,005
Net earnings	322,817	120,188
Twelve months—		
Gross earnings	10,201,240	2,503,484
Net earnings	3,849,600	808,560

Standard Gas & Electric Co. Subsidiaries.

The combined earnings of the Standard Gas & Electric Co.'s public utility subsidiaries for the 12 mo. ended July 31, 1921, compare with the earnings of the corresponding previous year as follows:

	1921.	1920.
Gross revenue	$34,640,488	$29,879,805
Gross earnings*	33,191,939	28,482,025
Net earnings	11,693,883	10,889,438

*Does not include revenue collected for otner producing companies.

Louisville Gas & Electric Co. Sells Additional Bonds.

The Louisville Gas & Electric Co. has sold to the Harris Trust and Savings Bank, the Guaranty Trust Co. of New York, and E. H. Rollins & Sons, an additional block of $500,000 first and refunding mortgage 7% gold bonds, due June 1, 1923. The proceeds will be used for construction in and near Louisville, Ky.

United States Light & Heat Corp.

For the year ended Dec. 31, 1920, U. S. Light & Heat Corp. reports deficit, after charges and taxes, of $256,280. The condensed balance sheet of the U. S. Light & Heat Corporation, as of Dec. 31, 1920, shows as follows: Assets: Real estate, plant, and equipment, $2,594,811; investments, $155,518; patents and good will, $4,363,595; cash, $96,712; bills and accounts receivable, $552,818; inventories, $1,622,862; cash in sinking fund, $143; deferred charges, $161,893. Total, $9,548,-352. Liabilities: Preferred stock, $2,995,-150; common stock, $3,778,250; accounts payable, $426,129; notes payable, $279,-835; accrued interest and taxes, $25,822; Willys Corporation note, $802,154; first mortgage 6% gold bonds, $936,800; reserves, $279,387; surplus, $24,825. Total, $9,548,352.

Dividends.

	Term.	Rate.	Payable.
Am. Pub. Serv., pfd.	Q	$1.75	Oct. 1
Ark. Val. Ry. L. & P., pfd.	Q	1.75%	Sept. 15
Athens Ry. & El., pfd.	Q	1.25%	Oct. 1
Can. Gen. El., com.	Q	2%	Oct. 1
Can. Gen. El., pfd.	SA	3%	Oct. 1
Bangor Ry. & El., pfd.	Q	1.75%	Oct. 1
Central States El., pfd.	Q	1.75%	Oct. 1
Colo. Pr., pfd.	Q	1.75%	Sept. 15
Cons. Gas El. Lt. & Pr.	Q	$2	Oct. 1
El Paso El.	Q	$2.50	Sept. 15
Manila El. Ry. & Lt.	Q	$1.50	Oct. 1
Manhattan El. Sup.	Q	$1	Oct. 1
Okla. Gas & El., pfd.	Q	1.75%	Sept. 15
Penn. Central L. & P., pfd.	Q	$0.90	Sept. 10
Wis.-M. L. & P., pfd.	Q	1.75%	Sept. 1
E. Wis. El., pfd.	Q	1.75%	Sept. 1

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid Sept. 6.	Bid Sept. 12.
Adirondack Electric Power of Glenns Falls, common	6	8½	10
Adirondack Electric Power of Glenns Falls, preferred	6	70	69
American Gas & Electric of New York, common	..	100	101
American Gas & Electric of New York, preferred	6	37½	37½
American Light & Traction of New York, common	..	93½	93½
American Light & Traction of New York, preferred	6	79	79
American Power & Light of New York, common	4	55½	57
American Power & Light of New York, preferred	6	65½	66
American Public Utilities of Grand Rapids, common	..	9	10
American Public Utilities of Grand Rapids, preferred	..	17	17
American Telephone & Telegraph of New York	9	106	..
American Water Works & Elec. of New York, common	..	4	4
American Water Works & Elec. of New York, particip	7	8	8
American Water Works & Elec. of New York, 1st preferred	..	46½	47
Appalachian Power, common	..	4	4½
Appalachian Power, preferred	7	30	31
Cities Service of New York, common	+extra	118	120
Cities Service of New York, preferred	6	44	44
Commonwealth Edison of Chicago	8	108½	108½
Comm. Power, Railway & Light of Jackson, common	..	10	10
Comm. Power, Railway & Light of Jackson, preferred	6	28	28½
Federal Light & Traction of New York, common	..	7	6½
Federal Light & Traction of New York, preferred	..	41	44½
Northern States Power of Chicago, common	..	42	43
Northern States Power of Chicago, preferred	ex.div.7	79½	79½
Pacific Gas & Electric of San Francisco, common	..	54½	56
Public Service of Northern Illinois, Chicago, common	7	79	78
Public Service of Northern Illinois, Chicago, preferred	6	80	80
Standard Gas & Electric of Chicago, common	..	8	7½
Standard Gas & Electric of Chicago, preferred	8	34	33½
Tennessee Railway, Light & Power of Chattanooga, common	..	¾	¾
Tennessee Railway, Light & Power of Chattanooga, preferred	6	3½	4
Western Power of San Francisco, common	..	25½	26
Western Union Telegraph of New York	..	82½	..
Industrials—			
General Electric of Schenectady	8	123	126
Westinghouse Electric & Mfg. of Pittsburgh, common	7	43½	45½